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AUTOMOBILE INDUSTRY IN INDIA

THE question of establishing an automobile factory in India is just a part of the general scheme of industrialising the country, and, if it is agreed that the development of all the available material resources of this great sub-continent is desirable and necessary for the promotion of the prosperity and the well-being of the Empire, it is inconceivable why the modest proposals for the inauguration of a motor factory in Bombay were discouraged. It will be remembered that in connection with framing the outline of the project, Sir M. Visvesvaraya had investigated the possibilities of this new venture in all its detail, by visiting a large number of automobile factories in Europe and America, and by consulting with their directors and technical experts. The report that he prepared after exhaustive enquiry, revealed the fact that practically all the experts consulted favoured the project, by offering active support and co-operation. It was a grave misfortune that, while the report was being sympathetically considered by the promoters of the scheme, they appear to have been suddenly seized with a spirit of pessimism in respect of the success of the proposals formulated in the report, and that they were almost inclined to believe the misleading doctrine that India would do better to buy foreign motor vehicles than build them in her own factories. The establishment of a large industry, such as the one Sir M. Visvesvaraya was contemplating, must necessarily affect vested interests and must even provoke a certain measure of hostility, but what is puzzling is that the hard-headed business men, who take a practical and a long-range view of industrial concerns,

should succumb to the blandishments of false and futile economic philosophy. In 1936, efforts were made to enlist the sympathy and the active support of the Government of Bombay and the Government of India. The Government of India were profuse in their sympathy, but adhered to the policy of discriminating protection for Indian industries, enunciated by the Fiscal Commission of 1921–22 and in pursuance of this policy the Imperial Government could offer no assistance to "an industry that was not started" and could therefore make no promise for the purchase of its products. The Congress Ministry, then in power in Bombay, however, offered provisionally a guarantee of 3 or 3·5 per cent. interest on a capital issue of Rs. 150 lakhs for the industry for a period of ten years. Before the concession could be finally sanctioned, the Congress Government went out of office.

If the survival value of a nation is measured by the encouragement that the Government gives to applied science and to industries, then, in all conscience, India's ability to survive in a world of competition looks terribly small. There are obviously formidable obstacles in the way of promoting both. Some of the obstacles lie in India's social system, but the majority of them are due to our own want of initiative, enterprise and solid co-operation. If, in addition to these fairly surmountable impediments, we encounter the unhelpful attitude of the Government, Indian large-scale industrial enterprises must, for a long time, remain in a sub-conscious stage. It was just here that the Congress Government could have rendered the greatest service to the country, had it not in such excessive haste, shed the reins of office. We may be almost certain that, if the Congress from its position of official power had applied its mind to the matter of collecting funds for war effort, fairly colossal amounts could have been raised. One of the uses to which a certain percentage of such funds could be applied would be the assistance rendered for the establishment of "key industries" in India. The Congress Ministries in the seven provinces in their combined capacity could have exercised their power of persuasion so as to secure for the new industries the countenance and encouragement of the Government of India. We have willingly sacrificed great opportunities of service.

While the Government of India is slow to accord its support to the scheme formulated for the institution of an automobile factory in Bombay, attention may be drawn to the extent to which the Commonwealth Government of Australia has lent encouragement to a local Company "before it proceeded to make the necessary arrangements to establish the industry in Australia". On December 19th, 1939, the Australian Parliament passed an Act known as "The Motor Vehicle Engine Bounty Act", which enabled the Government to enter into an agreement with the newly formed Company, the Australian Consolidated Industries, Ltd., providing for the payment of a bounty of £1,500,000 for the first 60,000 vehicle engines manufactured by the Company. It is worthwhile to reproduce here some of the main provisions in the agreement which would throw into relief the unsympathetic tenderness and unfriendly interest evinced by the Government of India towards such enterprises.

"Two-thirds of the paid-up value of shares should be owned by subjects resident in Australia.

"The Commonwealth Government will safeguard the interests of the Australian Company against the establishment of rival foreign companies.

"Government will use its power of import control to counteract any foreign trading methods by oversea interests in selling competitive vehicles in Australia.

"For five years from commencement of manufacture, the Commonwealth Government will purchase a substantial portion of its requirements from the proposed factory.

"Government will admit free of import duty such machinery as cannot be conveniently manufactured at the outset within a reasonable time.

"The Commonwealth Government will be prepared to examine upon request the measure of tariff or other assistance needed for import of any special automobile parts."

The Government of India no doubt is equally generous in the reverse direction in granting favours to foreign firms, but obstinately alert in withholding them from indigenous enterprises. In August 1940, the Associated Press announced from Simla the arrangements made by the Government of India with the local branches of the two American Motor Companies for obtaining the required number of motor vehicles for military purposes.

"The two great American Motor Companies, General Motors and Fords, which possess large assemblage and body-building plants in India, are co-operating with the Government in the production of vehicles for the Indian Army. Although it is not possible to state the numbers or types which are in production at these plants, it can be said that the present initial expansion of the Indian Forces involves an increase of between twenty and thirty thousand in the number of vehicles required by the Army. All these are divided into no less than 56 types. To assist in coping with these requirements, the American concerns have recently considerably extended certain sections of their works and these extensions, it is understood, will be specially devoted to urgent Government work."

Big questions of far-reaching significance will naturally arise from a consideration of the respective attitudes of the Commonwealth Government of Australia and of the Government of India, and we do not propose to enter the field sowed with salt and mustard powder. We may, however, pertinently ask whether, in case 50 per cent. of the facilities, which the Australian Parliament granted to the Australian Consolidated Industries, Ltd., in 1939, had been given to the Bombay Scheme in 1936, by the Government of India, the projected Indian Motor Compay would not be in a position to supply to the Government 50 per cent. of the "twenty and thirty thousand vehicles" which have been now ordered exclusively from foreign firms. Is the policy of discriminating protection so inflexible that it can afford to be stolidly and permanently indifferent to the prosperity of Indian industries; and have the Government of India no power to relax its rigours or render it capable of assisting large-scale industries? It will be interesting to read the report of the Roger Commission on the effects of this policy of discriminating protection on the destiny of India as an industrial country. We neglect the Indian cow, but wish to milk the foreign bull. A complete reorientation of the policy of the Government of India seems imperative, and, if this change does not occur now, we are afraid we will have to be "without industries and without applied science", nobody knows how long.

In the brochure before us, we notice that its author has made a fresh appeal to the Government of Bombay and the Government

of India for support and co-operation. From the former he wants confirmation of the guarantee of 3.5 per cent. on capital outlay, provisionally promised by the previous Congress Government, and from the latter, an assurance that the project may be treated as a war measure, capable of manufacturing and supplying army vehicles, that they might place with the projected local factory a substantial part of their order and grant reasonable tariff concession in connection with imports of parts and raw materials required by the factory. The very reasonableness and moderation of the appeal must be its best recommendation. Can not India have at least Industrial Swaraj?

It is unnecessary to emphasise the importance of an automobile industry to India, and yet India will not be wanting in apple-pie critics who will oppose every species of change or reform in the existing state of affairs. India suffers from three obsessions, Goats' Milk, Red Tape and Communal Adenoids. Any enterprise in any field, however innocuous and important, is easily brigaded under one of these political ingredients.

The tragic events of the War which have placed the Empire in a critical situation are attributable to the entire lack of scientific thought and scientific mode of approach and solution of national problems. We shall not have exhausted the resources of science by merely applying its knowledge to the present practical problems, but we ought to be able with its aid to predict future problems and to impress its services for their solution. It was in this spirit that Sir M. Visvesvaraya conceived his project of an automobile factory in India in 1936, which while rendering service in peace time, could be utilized for war purposes when such demands were made on the industry. It is not surprising that the Government have dealt with the proposal in their traditional grand style. In war, more particularly in its acute phases, such as those in which we find ourselves at the present moment, it might be supposed that temporary make-shift arrangements are what are most urgently required, and some may even be disposed to think that the time is inopportune for the inauguration of large-scale industries. According to such views, it would be safest for all concerned to follow traditional methods of thought and action. But wars shatter traditional methods because they introduce into our political, social and economic institutions unfamiliar and devastatingly new problems. It is only on a basis of quantitative knowledge that industrial problems can be formulated and that the need for the institution of new industries can properly be determined. The problem presented by Sir M. Visvesvaraya's brochure is definite and simple, and it is hoped that the Governments, to which appeals for support and encouragement for the projected factory have been preferred, will not be lacking either in ability or willingness to remove delays of industrial advancement and economic development in India. "Policies" are sacred, and they acquire more sanctity by furthering the industrial prosperity of the People. "Vested interests" are serious and they earn better respect by not injuring national interests.

TUBERCULOSIS IN INDIA

THE *Indian Medical Gazette* has issued a special tuberculosis number this month. In the preparation of this number and in the selection of contributions for inclusion, the editor has had the assistance of an editorial committee of the Tuberculosis Association of India. The contributors include many of the best-known tuberculosis workers in India and the contributions deal with a number of aspects of this subject which is so vital to India's health, but the majority are clinical articles written by specialists for the benefit of the practitioner.

Two important papers deal with conditions that may easily be mistaken for tuberculosis but are not tuberculous in origin; Dr. Ukil writes on chronic infections (non-tuberculous) of the lung, and Dr. Frimodt-Möller and Mr. Barton describe a condition which they call 'eosinoplile lung' that simulates tuberculosis very closely, particularly in its X-ray manifestations, and leads to much mis-diagnosis. This latter condition seems to be particularly prevalent in India and has not been described in other countries.

The sufferer from tuberculosis is not immune from other chronic diseases and *vice versa*; the combination of two diseases usually adds considerably to the risks associated with either of the diseases singly. Pulmonary tuberculosis associated with diabetes is an example. Dr. Benjamin and Verghese point out that the prospects of the patient is not so fatal as it was a few years ago before insulin and many of the more successful measures of dealing with diabetes were introduced and the immediate results in their hands have been comparatively good. Dr. Jones, of the Wanless Tuberculosis Sanatorium, describes the treatment of spontaneous pneumothorax, a common 'accident' in tuberculosis, and Dr. Samuel, of the same institution, that of tuberculous empyema. Other articles are on diet in tuberculosis and on tuberculosis in women with special reference to the question of tuberculosis and pregnancy.

On the subject of tuberculosis organisation there are two particularly valuable papers, one on the control of tuberculosis in the U.S.A., by Dr. Shah of the Public Health Department of the Punjab, who has recently spent some time in America, and the other, by Dr. Frimodt-Möller, the Medical Commissioner of the Tuberculosis Association of India. There is much inspiration to be gained from America's experience and much to be learnt, but there is little that can be translated directly into terms suited to Indian conditions. Dr. Frimodt-Möller on the other hand outlines a policy that can be adopted in India immediately and is yet capable of expansion.

Finally, the editor, Dr. L. E. Napier, emphasizes the importance of the adoption in India of a fixed policy, as he points out that vacillation shakes the confidence of the lay public without whose wholehearted co-operation any policy will fail. He considers that we know enough about tuberculosis in general, and conditions in India in particular, to frame such a policy, whilst at the same time making allowance for future advances in our knowledge and improvement in local conditions. He supports Dr. Frimodt-Möller's recommendations with the proviso that the establishment of industrial colonies for ex-patients is perhaps not really suited to Indian conditions as they exist to-day.

This is the fifth year in succession that the *Indian Medical Gazette* has published a special tuberculosis number. This number constitutes a valuable contribution to the subject and will be found of great interest, not only to medical men but to all interested in this aspect of the welfare of India and her people.

INDIAN AVIATION MAPS

THE writer of the article, "Indian Aviation Maps" in our May (1940) number was probably unaware that the style of the "Carte Internationale du Monde" series of maps is regulated by an International Committee, and that departures from the prescribed style are discouraged.

Another International Committee selected the above series of maps as the basis for a series of Aviation maps of the world.

In the Aviation series certain modifications are permitted; but, owing to the war, progress on this series has been and is likely to be slow.

PRESERVATION OF SALT-AFFECTED MURAL PAINTINGS FROM ANCIENT SHRINES IN CENTRAL ASIA

BY

MOHAMMAD SANA ULLAH

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THE decay of exhibits charged with soluble salts is a well-known phenomenon in museums, but it is sometimes extremely difficult to devise a remedy to counteract this evil. An acute problem of this kind has been offered by the mural paintings which are on exhibition in the Central Asian Antiquities Museum at New Delhi.

These paintings were discovered by Sir Aural Stein in ancient Buddhist shrines in the ruins of Central Asia, in the course of his expeditions extending over the periods 1906-08, and 1913-16. The paintings have been executed on mud plaster which is finished with a fine and smooth layer (*intonaco*) of the same material and a thin wash of burnt gypsum, made into cream with water, has been applied over this surface in order to form the painting ground. The colours employed are gypsum, red and yellow ochres, lamp black, malachite, terre verte and *lapis lazuli*, which were evidently mixed with a suitable medium (glue or gum), and applied with brushes on this ground which might have been still moist, or dried off completely.

In the process of mounting, as carried out in this museum, the slabs bearing the paintings were placed face down on a glass plate and the superfluous mud backing was carefully scraped off until the plaster was left only ⅛" to ¼" thick, *i.e.*, barely sufficient to hold the surface intact. Now the slabs were strengthened by the application of a thin layer of plaster of Paris cream on the backside. Several continuous slabs were then brought together in proper order to form a panel of convenient size, and an aluminium angle frame of suitable size, with expanded aluminium netting stretched across it, was placed over these slabs in the correct position. Sufficient plaster of Paris cream was then poured all over the slabs to cover the meshes until the whole assemblage was embedded in a uniform layer of the plaster. When the plaster had set hard the whole was lifted up from the glass plate as one unit. The section of such a unit is shewn in Fig. 1. For exhibition, these aluminium

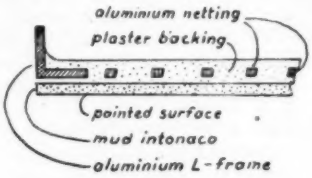

FIG. 1

frames were arranged in proper order and hung against the walls of the museum, by means of adjustable hooks resting on fixed iron chanelling; so that an empty space, about 2" wide, was left between the wall and the panels. The paintings have been finally encased in wooden almirahs with glazed doors in front. After the lapse of several years signs of decay developed on some of these paintings, which began to spread and affect several more in a short time. The decayed plaster was examined and found heavily charged with sodium chloride and sodium sulphate. There is no doubt that the salts were present in the original plaster, since the ruined sites (whence these paintings were recovered) are situated in very saline areas. The decay of the surface was caused by a continuous cycle of solution and crystallization of the salts, which is set up by variation in atmospheric humidity. In the wet season, when the humidity remains excessive over long periods, the salts remain in solution and do not get a chance to crystallize. However in the dry weather the humidity of air remains low during the day; but it may rise up to the saturation point at night with the fall of temperature. Therefore the cycle is repeated with great frequency and rapid decay occurs. This explains the marked intensity of decay due to injurious salts, in the cold season.

The atmospheric conditions prevailing in the museum galleries, also cause the salts to move out and concentrate gradually on the painted surface, which is consequently subjected to severe deterioration. In the rainy season, the exposed walls as well as the floors of the museum absorb appreciable

amounts of water which is given off to the air slowly for a long time afterwards. Therefore, the 2" airspace (which exists between the walls and the picture panels), must have remained saturated with moisture for sometime after the rains when the humidity of atmosphere in the gallery had fallen low. In other words, necessary conditions for the establishment of a humidity gradient across the picture panels must have prevailed in certain parts of the year, which would force the salts in the panels to move out and concentrate on the painted surface.

Before going further it seems desirable to explain the principle underlying the movement of salts in porous bodies under the influence of a humidity gradient. It is well known that if one side (A) of a porous partition is exposed to higher atmospheric humidity than the other (B), then movement of water vapour takes place through the partition from surface A to surface B. Suppose the porous partition be impregnated with soluble salts and the Relative Humidity on the surface A is sufficient to cause the salts to deliquesce while that (Relative Humidity) on B is low enough to cause their efflorescence, then the salts will go into solution at the surface A, spread through the material by capillary action, and crystallize out gradually at the surface B. This process will go on as long as the humidity gradient is maintained. In other words the salts also will move from A to B and concentrate at this surface.

The material of the *intonaco* (i.e., mud) and tempera style of the paintings preclude the application of wet paper pulp or soaking in water, which constitute the common methods for the elimination of soluble salts from more rigid materials, such as terracotta, stone, etc. Coating with cellulose acetate and vinyl acetate solutions were tried but failed to arrest the process of decay, due to the fact that the thin films are not impervious to moisture. After much experimentation it was decided to break the concentration of the salts on the soft painted surface and to induce them to concentrate on the surface of the plaster backing instead by the reversal of the humidity gradient. In actual practice, the treatment of these salt-affected panels has been carried out in a specially designed apparatus, named 'Humidity Chamber', which is illustrated in Figs. 2 and 3. This device consists of a

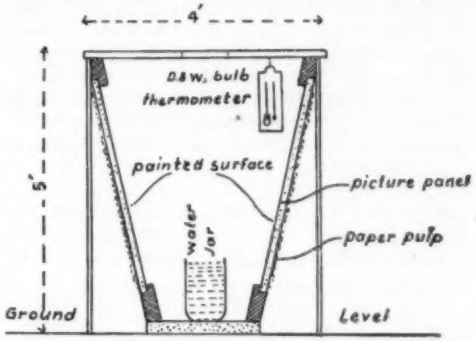

FIG. 2

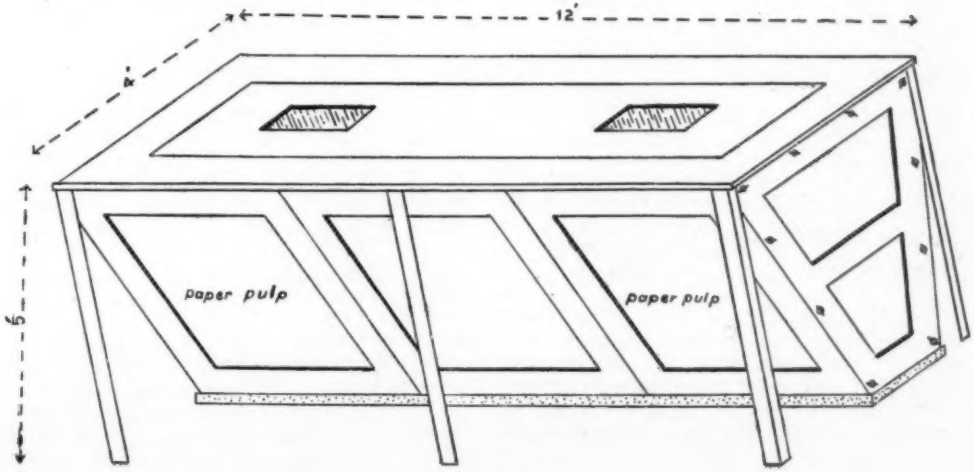

FIG. 3

skeletal frame of L-iron, having a trapezoidal section, which is supported on six iron uprights fixed in the ground. The top is covered by a wooden lid provided with two glazed windows, which is fixed down by means of fly-bolts and nuts. The flanks of the chamber are also provided with wooden frames, which can be partitioned off into two or more rectangular sections for the insertion of wooden adapters of suitable sizes. A number of frames bearing the paintings are secured to the sides of the chamber, with their painted surface inside, by screwing down wooden batons over them while the joints are rendered tight by means of felt packing. The front and back ends of the chamber are provided with glazed doors which can also be closed tightly by means of fly-bolts and nuts. A number of glass jars containing water are kept inside the chamber to humidify the air. Dry- and wet-bulb thermometers are suspended inside and outside, to indicate the relative humidities respectively. The slanting position of the panels helps to retain any fragments that may have loosened in the process of decay. The Relative Humidity inside is kept above 85 per cent.

After a week or so, paper-pulp of the consistency of porridge is applied to the outer (plaster) surface of the panels until a uniform layer ½" thick has been laid all over it. The pulp generally adheres well but if the surface of the plaster is smooth it will tend to fall off. Therefore it will be necessary to keep the pulp in position by propping it at several points with the aid of flexible sticks, or, the whole surface may have to be pressed down by means of galvanized wire-netting of wide mesh fixed tightly over a wooden frame. Sometimes mildew develops in the pulp which will affect the paintings also. In order to counteract this danger it is desirable to sterilize the chamber by heating a quantity (½–1 oz.) of thymol inside, at intervals. Coating with thymol solution in alcohol was not found to be effective. However, the most effective remedy consists in the addition of a little carbolic acid to the paper-pulp mix-up.

The Humidity Chamber having been properly closed, the layer of the pulp is allowed to dry off, which takes a week or more, when it is removed carefully with the aid of a knife's point. Six-inch square specimen of the dried pulp is cut up, soaked in distilled water and its salt contents are estimated in a colorimeter. The applications of paper-pulp are repeated until mere traces of the salts can be detected. The panels are now removed from the chamber and the painted surface is impregnated with 5% vinyl acetate solution in toluene, until it has been strengthened sufficiently. Finally, the surface is pressed down gently with hot iron. A few typical examples of the analytical results are given below:—

Grams of sodium chloride found in one square foot area of the dried paper-pulp, in successive applications

Specimen	Paper-pulp applications							Remarks
	1	2	3	4	5	6	7	
(a) Panel Gha ..	10·0	2·4	1·0	0·43	0·72	0·38	tr.	Highest concentration found
(b) Panel M.C. 08 ..	2·2	0·7	0·13	tr.				
(c) Panel M.C. 111, 01 ..	1·1	0·67	0·4	0·043				
(d) Panel Kao 11·03 ..	?	?	0·25	0·40	0·64	0·30	tr.	
(e) Panel Bez XIII *(a)*	0·69	0·24	0·32	0·11				
(f) Do. *(b)*	0·80	0·14	0·13	0·10				

Finally it may be mentioned that this process works very slowly and takes several weeks to bring down the concentration of salts to a small fraction.

ALGAL INVESTIGATIONS IN THE BOMBAY PRESIDENCY

BY
S. C. DIXIT
(Wilson College, Bombay)

THE history of the beginning of scientific exploration and recording of the plants in the Bombay Presidency commences with the arrival of the Portuguese at Bassein in the Island of Salsette about 1838 A.D. In those early days the object of botanical researches was to collect plants for the economic uses. A physician, named Garcia d'Orta has recorded some well-known medicinal and economic plants of this region. The man who materially laid the foundation of Systematic Botany of the Bombay Presidency was John Graham, a Deputy Postmaster-General. He published a "Catalogue of Plants Growing in Bombay and its Vicinity" in 1839. Thereafter, during the last hundred years the flowering plants have been investigated by several successive workers. But the lower plants and specially the algæ practically remained unnoticed for a long time. The systematic study of the Cryptogams is in fact comparatively a later step in the field of botanical research. The second half of the last century was the period of serious algological studies. The fields of the pioneer workers on Indian algæ were mostly outside this province.

The oldest record of algal collection from the Bombay Presidency is that of *Nitella acuminata* Br. and *Nitella dispersa* Br. made by Stokes in 1847. A paper on some Volvocales from Bombay was published by Carter in 1859.[1] During the last quarter of the century several attempts appear to have been made to study the marine algæ of the Presidency. Vice-Admiral Pullen had collected seaweeds from the coast of Karachi but J. A. Murray (1881–83) has left a more lasting mark of his own collection by recording some marine plants in his book on the plants of Sind. It is interesting to read a note in the *Journal of the Bombay Natural History Society*, 1887 which says: "Mr. Murray, late Curator of the Kurrachee Museum, exhibited a collection of Marine Algæ consisting of 212 species from the Coast of Sind, and described the same." The same Journal records that Mr. Kirtikar read a paper on Marine Algæ collected by Hon. Justice Birdwood on the Ratnagiri Coast. Kirtikar was a medical man and he has published a brief paper[2] wherein he describes a new species, *Conferva thermalis Birdwoodii* from the hot springs of Vajarabai in Thana District. He has noted three more species, *viz.*, *Ulothrix radicans* Cooke; *Nostoc* sp.; and *Chætomorpha implexa*. It is needless to point out that this information is of only historical importance and would hardly stand the test of science.

In the beginning of the present century (1902–03) an account of some Myxophyceæ collected by Hansgirg in India was published.[3] Hansgirg's collection included about twenty-five species belonging to seventeen genera of the blue-green algæ from the vicinities of Bombay and Poona, majority of which was considered to be new to science. In 1909, Hate published a note on two species of Charophytes, *viz.*, *C. verticulata* and *C. flacida* Br. from the Bombay Island. In 1924 Groves[4] published an important paper on the Charophytes of India wherein he recorded seven species from the Presidency collected by six different people at various times. Two years later, very brief references about the collections of algæ made by Hate (V.N.) and Dixit (D.L.) appeared in the abstracts of papers read at a meeting of the Indian Science Congress. In the same year, Carter published a paper on the Freshwater Algæ from India in which she mentioned two green algæ, *viz.*, *Rhizoclonium hieroglyphicum* Kutz. and *Pithophora radians* W. & G. S. West from Bombay. Thus, upto the close of the first quarter of the present century our knowledge of algæ of this region was next to nil.

In 1927–28 the University of Bombay invited Dr. F. Boergesen of Copenhagen to investigate the marine vegetation of the Presidency. Dr. Boergesen with the help of some teachers and students of the University made large collections of marine algæ from Bombay and Dwaraka. This was indeed the most important landmark in the history of algology in the Presidency. During the last decade or so Boergesen has published a series of papers on his Indian collections.[5,6] Boergesen found a very impressive algal vegetation at Dwaraka and in

one of his earliest papers he has remarked: "Such a veritable littoral algal vegetation within the tropical zone, where everyday the algæ are laid dry for several hours, exposed to the heat of the burning sun and the strong evaporation in this very dry part of India is so far as I know something quite unknown." He has also confirmed that the geographical distribution of some tropical and sub-tropical marine algæ is discontinuous. The marine myxophyceæ have not been touched by him excepting the five species found at Bombay. As a result of his investigations he has added five new genera and thirty-eight new species to science and altogether he has recorded near about two hundred species from the Bombay Presidency alone.

All these years the freshwater algæ made no headway and they had been practically neglected. However, in 1931 the author published a short paper on the Charophytes and this was followed by a series of papers on other freshwater algæ of the Province.[7–10] Twenty species of Charophytes and about seventy-five species of other algæ have been recorded. In 1936 Apte published an account of four species of Volvox from Poona in the *Journal of the University of Bombay.*

Apart from the taxonomic and morphological work mentioned above, practically no work has been done so far on other aspects of algal life. In 1930 the writer[11] determined the percentage of iodine in certain algæ and in 1935 Cooper and Pasha[12] investigated the osmotic pressure and H-ion concentration of seaweeds in relation to those of sea-water.

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[1] Carter, H. J., *Ann. Mag. Nat. Hist.*, 1859.

[2] Kirtikar, K. R., *J. Bom. Nat. Hist. Soc.*, 1886, **1.**

[3] Hansgirg, A., *Prag. Citz. Ber. Bohm. Gess. Wiss.*, 1902 & 1903, No. 28.

[4] Groves, J., *J. Linn. Soc.*, 1924, **46,** 359.

[5] Boergesen, F., *Det. Kgl. Danske Videnskabernes Selskab. Biologiske Meddelelser*, 1933, **10.** 8.

[6] —, *Ibid.*, 1935, **12,** 2.

[7] Dixit, S. C., *J. Ind. Bot. Soc.*, 1940, **18.**

[8] —, *Proc. Ind. Acad. Sci.*, 1936, **3.**

[9] —, *Ibid.*, 1937, **5.**

[10] —, *J. Univ. Bom.* March 1940.

[11] —, *J. Ind. Chem. Soc.*, 1930, **7.**

[12] —, Cooper, R. E , and Pasha, S. A., *J. Ind. Bot. Soc.*, 1935, **14,** 237.

OBITUARY

SIR ROBERT HADFIELD

THE death of Sir Robert Abbot Hadfield, Bt., D.Sc., F.R.S., removes the most outstanding figure in the field of Metallurgy. He really belonged to the latter half of the last century, having become world-famous by the discovery of his Manganese Steel in 1888. The importance of manganese in the making of steel was first realised by Sir Henry Bessemer, but it was not until the systematic researches of Sir Hadfield on the alloys of iron and manganese culminated in the discovery of the famous Manganese Steel, that the further development of alloy steels became possible. Quite apart from the wonderful properties of the newly discovered alloy, the method of Sir Robert Hadfield's researches attracted wide attention from all the leading metallurgists of the day. It may not be out of place to refer here to the tribute paid to him in 1903 by Prof. Osmond, one of the great leaders in the development of modern metallurgical thought:

"The series of the Hadfield alloys had been prepared with a degree of technical skill which upset many falsely conceived ideas, resulting from imperfect preparation or from faulty manipulation. Hadfield's method was a truly scientific one, by means of which all the independent variables which could be disposed of were eliminated. With the materials for investigation thus prepared, which for a long time had been unrivalled, the results obtained were at once clear, coherent and definite. Moreover, Hadfield had not only made the best personal use of this wealth of material but with never-failing generosity, of which the writer had many times availed himself, he had placed it at the disposal of those inventors who were desirous of subjecting it to their methods and using it for their researches. Consequently the useful results had gone on increasing and from the accumulations of these the general laws had been evolved,

which formed the main object of all research."

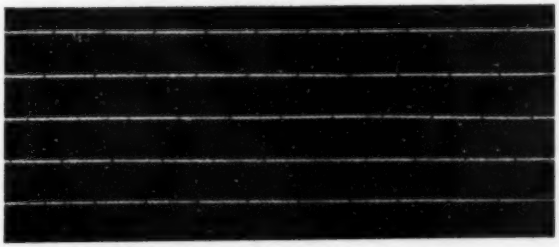
That Sir Robert was not only the inventor of Manganese Steel, but also the pioneer in the field of other alloy steels is not generally known. It is claimed by some that he was a true prophet in regard to the ever-increasing importance of these special steels. In his paper on "Alloys of Iron and Chromium" presented to the British Iron and Steel Institute in 1892, he said, "The author cannot but think that the special question of steel alloys or combinations will be eventually found to possess considerable practical importance to the world at large and perhaps be the means of eventually enabling our Civil and Mechanical Engineers to design and carry out works of great magnitude". How true this forecast is, made thirty years ago, will easily be realised by the modern technicians.

Sir Robert Hadfield was Chairman of the firm Hadfields Ltd., Sheffield, and director of a number of other companies. He was connected with a number of technical societies and was President of British Iron and Steel Institute from 1905–07. He was awarded in 1904 the Bessemer Gold Medal. In 1908 he was knighted and the following year became F.R.S. He has contributed a number of valuable papers to the Iron and Steel Institute and other technical Institutions.

THE SEVERE CYCLONIC STORM OF 16th OCTOBER 1940

A DEEP depression off the Konkan-Kanara coast developed into a severe cyclonic storm which moved towards Bombay at 2 a.m. (I.S.T.) on the 16th October 1940, and about six hours later crossed the coast near Bombay causing considerable damage in and round the City. The barometer at the Colaba Observatory showed a fall of 0·27 inches between 10–30 p.m. on the 15th and 8 a.m. on the 16th. The minimum reading of the barometric pressure was 29·42 inches as read from the microbarograph. This occurred at 7–45 a.m. on the 16th at which instant a single gust of wind reached a hurricane force of 75 miles per hour, and the wind force remained very high from about 7–30 a.m. till about 8–30 a.m. during which the average windspeed was as high as about 60 miles per hour. Both these values are so far the highest on record at the Colaba Observatory.

Microseisms at the time of the Cyclonic Storm on 13-10-40



Microseisms on the day previous to the Storm

The Milne-Shaw seismograph recorded the strongest microseisms ever recorded by the instruments here till now. Portions of this record as also that of the day previous are reproduced here for comparison.

The microbarograph shows very rapid fluctuations of the pressure between 5–45 a.m. and 10–45 a.m. on the 16th. The storm abated at about 12–30 p.m. on the 16th.

M. R. RANGASWAMI,
Colaba Observatory,
Bombay,
October 17, 1940.

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On Poincaré's Theorem in Stellar Dynamics

THE major problems of stellar dynamics are concerned with systems of discrete gravitating particles which are virtually free from an external field of force. Poincaré's theorem[1] for such systems is usually expressed in the form

$$\frac{d^2}{dt^2}\Sigma m\rho^2 = 4T + 2V = 4h - 2V, \qquad (1)$$

where m is a typical mass of the system, ρ its distance from the origin, and T and V are the total kinetic and potential energies h being their sum. Without any loss of generality the centre of mass of the system may be supposed to be permanently at rest at the origin. From (1) it follows that when the steady state is reached

$$2T + V = 0 \qquad (2)$$

and $$T = -h, \quad V = 2h. \qquad (3)$$

The simplifying hypothesis of a steady state does not always fit in with facts and it is therefore worthwhile looking into possible rates of condensation and disintegration for such systems. These considerations also help us to determine the age of a system.

Let us consider the parameters S, R defined by

$$S \equiv \Sigma m\rho^2 - 2ht^2 = MR^2 - 2ht^2, \qquad (4)$$

where M is the total mass of the system. (1) is now equivalent to

$$\ddot{S} = -2V \qquad (5)$$

Hence $$\ddot{S} \geqslant 0 \qquad (6)$$

Also $$\dot{S} = 2(\Sigma m\rho\dot{\rho} - 2ht) \qquad (7)$$

We have

$$\frac{\dot{S}^2}{4} = S[\Sigma m\dot{\rho}^2 - 2h] + 2h\Sigma m(\rho - \dot{\rho}t)^2 - \sum_m \sum_{m'} mm'(\rho\dot{\rho}' - \rho'\dot{\rho}) \qquad (8)$$

Now $$\Sigma m\dot{\rho}^2 - 2h = -2V - 2T' \qquad (9)$$

where T' is the kinetic energy of rotation. If the resultant angular momentum is a it can be easily shown[2] that

$$T' \geqslant a^2/(S + 2ht^2). \qquad (10)$$

We may therefore write

$$T' = a^2z/(S + 2ht)^2 \qquad (11)$$

where $$Z \geqslant 1 \qquad (12)$$

Thus

$$\frac{\dot{S}^2}{4} = S\left[-2V - \frac{2a^2z}{S+2ht^2}\right]$$

$$+ 2h\Sigma m\,(\rho - \dot{\rho}t)^2 - \Sigma\Sigma mm'\,(\rho\dot{\rho}' - \rho'\dot{\rho})^2. \quad (13)$$

Using (5), the last equation can be restated as

$$S\ddot{S} - \frac{\dot{S}^2}{4} - 2a^2z\,\frac{S}{S+2ht^2} =$$

$$\Sigma\Sigma mm'\,(\rho\dot{\rho}' - \rho'\dot{\rho})^2 - 2h\Sigma m\,(\rho - \dot{\rho}t)^2. \quad (14)$$

It is obvious that for particles satisfying the equation of Milne's law of recession,[3] *viz.*,

$$\dot{\rho} = \rho/t, \quad \dot{\rho}' = \rho'/t, \text{ etc.} \quad (15)$$

the right-hand side of (14) vanishes. But (15) cannot be rigorously true for a classical system of gravitating particles as (14) clearly shows.

It is possible to discuss to some extent the evolution of a stellar cluster with the use of the parameter S. For if $\dot{S}$ is non-negative when $t = 0$, S is always positive and increasing by virtue of (6). In case $\dot{S}$ is negative initially S may attain a minimum or decrease indefinitely. The system is hyperbolic, elliptic or parabolic in character according as h is positive, negative or zero respectively. For an elliptic or parabolic system S will always be positive and if $\dot{S}$ is initially negative so that the system is shrinking ($\dot{R} < 0$) in its early stages S attains a minimum before proceeding to increase indefinitely. For a hyperbolic system S always increases or decreases or the first phase of decrease is followed by the second of uninterrupted increase.

These simple characteristics of the behaviour of S can be utilized in inferring the past and predicting the future of stellar clusters. R may very conveniently be taken as a measure of dispersion since the variation in the masses of stars is generally small. For an expanding hyperbolic cluster let $R = R_0$ at $t = 0$ and $R = R_1$ at $t = t_1$. Then

$$R_1^2 - \frac{h}{M}\,t_1^2 > R_0^2.$$

Hence $$\left\{\frac{(R_1^2 - R_0^2)M}{h}\right\}^{\frac{1}{2}} > t_1 \quad (16)$$

Similarly a lower limit on time can be determined for condensing systems for which h is negative.

Stellar considerations apart, the statement of Poincaré's theorem in the form (5) with the immediate conclusion (6) and the equation (14) are believed to be two new results sufficiently important in their own rights.

V. V. Narlikar.

Department of Mathematics,
Benares Hindu University,
October 7, 1940.

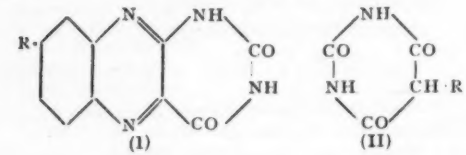
[1] Smart, W. M., *Stellar Dynamics*, 1938, 310.
[2] Birkhoff, G. D., *Dynamical System*, 1927, 266.
[3] Narlikar, V. V., *Nature*, 1935, **149**, 135.

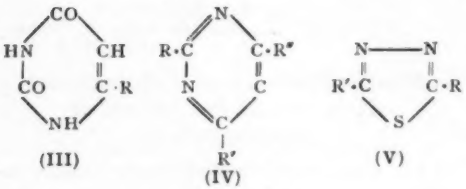
Further Synthesis of N¹-Substituted Heterocyclic Derivatives of Sulphanilamide

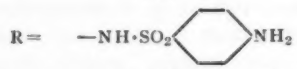
It has been pointed out previously[1] that compounds more polyvalent in therapeutic action than sulphanilamide should be looked for amongst its derivatives wherein the amino group is free and the sulphonamide radical carries a suitable heterocyclic substituent. In the choice of the heterocyclic rings for the synthesis of such a class of compounds, we were mainly guided by the ring systems present in the reputed antiseptics, chemotherapeuticals of established value in the protozoal infections and, of recently, the products with vital biochemical functions, *e.g.*, the vitamins, coenzymes, nucleic acids, etc. Working with this programme, in addition to those reported previously,[1] some more sulphanilamido derivatives of the typical ring systems have been synthesised to serve as model compounds for future search.

7-Aminoalloxazine,[2] uramil (obtained by reducing violuric acid with sodium bisulphite) and 4-aminouracil[3] have been converted into the corresponding sulphanilamido derivatives of formula (I), (II) and (III) by condensing with p-acetaminobenzene sulphochloride and hydrolysing the products obtained in the usual ways,[1]

Similarly, 2-sulphanilamido-pyrimidine (IV, R′ = R″ = H), the corresponding 4-methyl (IV, R′ = Me, R″ = H) and 4 : 6-dimethyl derivatives have been synthesised by three different methods. Adenine and 4 : 5-diaminouracil have also yielded the sulphanilamido derivatives with one molecule of the sulphochloride); but in these cases, a decision between the two possible structures has not been made.







2-Amino 1 : 3 : 4-thiodiazole and 2-amino-5-methyl 1 : 3 : 4-thiodiazole have similarly yielded 2-N¹-sulphanilamido-1 : 3 : 4-thiodiazole (m.p. 216–18°) (IV, R = H) and 2-N¹-sulphanilamido-5-methyl thiodiazole (m.p. 180–82°) (IV, R = CH_3) respectively.

Similar derivatives of the above and related structures are being synthesised.

Full details will shortly be published.

These compounds are being tested in the usual experimental bacterial infections.

K. GANAPATHI.

Haffkine Institute,
Parel, Bombay,
October 1, 1940.

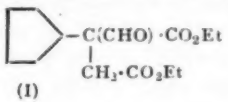
[1] Ganapathi, K., *Proc. Ind. Acad. Sci.*, 1940, **11**, 298; **12**, 274; *Ind. Jour. Med. Res.*, 1940, **27**, 971; *Curr. Sci.*, 1940, **9**, 314.

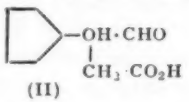
[2] *J. Ind. Chem. Soc.*, 1938, **15**, 77.

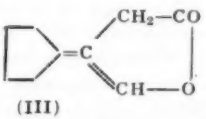
[3] *Ibid.*, 1937, **14**, 627.

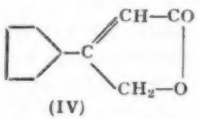
Lactones Related in Structure to Cardiac Aglucones: The Lactone of β-*Cyclo*pentyl β-Aldehydo-Propionic Acid

As early as 1937, work was started by the author with a view to synthesising lactones related in structure to cardiac aglucones.[a] In a detailed communication published last year,[1b] a standard method was described for the synthesis of β-ring substituted succinic acids as an essential groundwork for the larger plan of synthesis of the lactones. A scheme for the synthesis of the lactones was given, and applying the scheme to the case of α-*cyclo*pentyl succinic acid (I), and its successful if peculiarly difficult, conversion to β-*cyclo*pentyl-β-aldehydopropionic acid (II) were described. The accumulation of large amounts of (II) to convert it into (III)[2] a β-substituted βγ-unsaturated-γ-lactone of the type found in cardiac aglucones—was being delayed but was, however, pursued. In a very recent communication[3] Elderfield and his collaborators have,





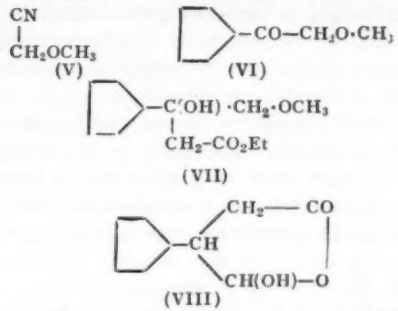




without giving experimental details, outlined a different method of synthesis of such lactones. In their scheme, lactones of type (III) are obtained through the isomeric αβ-unsaturated lactones of the type (IV). We have sought to apply this new scheme in the case of the synthesis of (III) and (II). We have succeeded in obtaining them, and hence there can be no doubt about the validity of the various structures in either of the two schemes.

Methoxy acetonitrile (V)[4] was condensed with the Grignard reagent from *cyclo*pentyl bromide to yield the ketone (VI), b.p. 192–194°/680 mm. (2 : 4-dinitrophenyl hydrazone, m.p. 130°). The ketone on treatment with zinc and ethyl bromoacetate furnished in excellent

yield the hydroxy ester (VIII), b.p. 140°/6 mm. Simultaneous dehydration, demethylation and



(V) (VI) (VII)

(VIII)

lactonisation of (VII) was effected by HBr in acetic acid. Distillation of the product so obtained yielded in the place of the expected $\alpha\beta$-unsaturated lactone[2] (IV), the requisite $\beta\gamma$-unsaturated-γ-lactone (III),[5] b.p. 155°/5 mm. The proof for the structure (III) would seem to lie in the fact of its immediate response to the very characteristic Legal's test,[6] its slow reduction of the Tollen's reagent,[5] and its rather high b.p. This point is, however, kept open. On treatment with absolute methyl alcoholic potash (3%), (III) furnished the hydroxylactone, presumably (VIII), tautomeric with the aldehydo acid (II). The semicarbazone of this newly prepared aldehydo acid melted at 196° and under identical conditions of heating* the semicarbazone previously described by the author[1b] melted at 196°, and the mixed m.p. of the two specimens was not depressed.

The lactone (III) is almost insoluble in water and is not affected appreciably by prolonged boiling with water. Further work is being carried on in the direction of incorporating features in (III) which would make it water-soluble.

S. K. Ranganathan.

Dept. of Pure & Applied Chemistry,
Indian Institute of Science,
Bangalore,
July 27, 1940.

[1a] Ranganathan, *Curr. Sci.*, 1937, **6**, 277.
[1b] —, *J. Ind. Chem. Soc.*, 1939, **16**, 107.
[2] Windaus, *Wiss. Math. Phy. Kl. Gottingen*, 1935, **70**, 35.
[3] Fried, Rubin, Paist and Elderfield, *Science*, 1940, **91**, 435.
[4] Henze and Rigler, *J. Amer. Chem. Soc.*, 1934, **56**, 1350.
[5] *Cf.* Wolff, *Annalen*, 1885, **229**, 250, 254.
[6] Jacobs, Hoffmann and Gustus, *J. Biol. Chem.*, 1926, **70**, 1.
* The melting point varies with the rate of heating.

Soap Gels in Pinene

Prasad and Mathur[1] found that sodium oleate dissolves in pinene at 140° and the clear solution sets, on cooling, to a transparent gel. It has been found by the authors that potassium oleate, sodium palmitate and sodium stearate also dissolve in pinene when heated to 140°, and a clear solution thus formed sets, on cooling, to a transparent gel. The time of setting of these gels has been determined by Fleming's method and has been found to decrease with (i) an increase in the amount of soap in the gel and (ii) a decrease in the temperature at which the solution is allowed to cool.

All these gels exhibit the phenomenon of syneresis but the rate of syneresis of different gels is different. It is maximum in the gels of sodium oleate and least in those of sodium palmitate.

A systematic study of the several properties of these gels has been started in this laboratory and some of the results obtained are being communicated for publication elsewhere.

Mata Prasad.
C. V. Viswanath.

Chemical Laboratories,
Royal Institute of Science,
Bombay,
September 30, 1940.

[1] Prasad and Mathur, *Curr. Sci.*, 1940, **9**, 119.

Iwanoffia terrestris (Iwan.) Pascher from Fyzabad

This terrestrial member of the order Chætophorales was originally described by Iwanoff from Russia in 1899 as *Stigeoclonium terrestre*. It was found growing on moist earth. On account of the presence of biciliate macro- and micro-zoospores, Pascher described it as a new

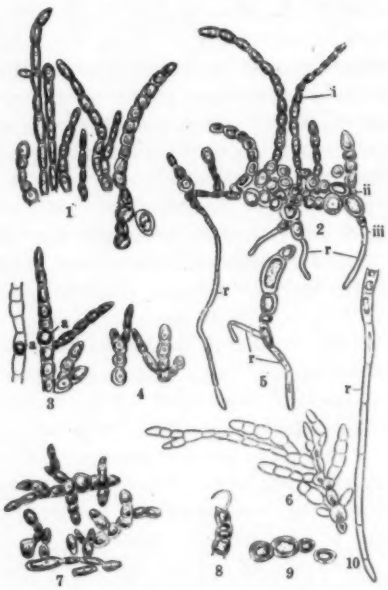
genus named as *Iwanoffia* in 1905. *Iwanoffia* differs from *Stigeoclonium* in its terrestrial habitat and the presence of biciliate macro- and micro-zoospores, which are quadriciliate in *Stigeoclonium* which is a purely aquatic genus.

So far *Iwanoffia* has not been recorded from India. This alga which resembles Iwanoff's alga in many features was originally collected by the present author in January 1939 growing on moist bricks of the arch of a masonry bridge over a small dried ravine near Bharat Kund in Fyzabad district. It formed a yellowish-green encrustation on the bricks resembling the coating of *Pleurococcus* on pitchers and moist wood-work during the monsoons. Only the lowermost tiers of bricks which were in contact with the moist clay of the ravine had the covering of this alga. Mostly it was found in the form of a pure growth, and only in a few patches the protonema of a moss was found mixed with it. Later on it was also collected in the dry months of April, May and June, when it appeared in the form of a yellowish-brown powdery covering.

The plant body in this alga is differentiated into three well-marked regions, which may be described as projecting, prostrate, and rhizoidal systems. In this respect this alga resembles *Fritschiella tuberosa* Iyengar as the general scheme of organization of the thallus is the same in both. However, in detail differences are numerous, and when closely examined this alga is readily distinguishable from *Fritschiella*.

Projecting System.—Filaments of the projecting system are usually unbranched and curved in a bow-like manner (Figs. 1 and 2). However when branching occurs, it is very sparse, and it is rare to find branches of a second or third degree (Figs. 4 and 5). In this respect this alga differs markedly from *Fritschiella* with its characteristic richly-branched fanlike projecting system. Terminal cells have blunt apices. Each cell contains a single ulotrichaceous chloroplast, each bearing a solitary pyrenoid. Chloroplasts are deep green in colour in specimens collected from moist bricks, while they are slightly bluish-green in samples scraped from dry bricks. Cells of the projecting system are 5–9 μ broad and 9–27 μ long and are cylindrical to barrel-shaped in appearance. Filaments of the projecting system are rather loosely connected with the cells of the prostrate system and easily get detached.

Prostrate System.—Cells of the prostrate system, which are highly developed in this alga, form a dense mat-like parenchymatous structure closely encrusting brick-particles (Fig. 2). Cells of this system are usually more or less



Figs. 1–10. *Iwanoffia terrestris* (Iwan.) Pascher.

Fig. 1.—Filaments of the projecting system; Fig. 2.—A plant showing projecting filaments (i), parenchymatous cells of the prostrate system (ii), and rhizoids (*r*); Fig. 3.—Aplanospores (*a*); Fig. 4.—Branching in filaments of the projecting system; Fig. 5.—A dissected plant showing rhizoids (*r*); Fig. 6.—A part of a plant showing prostrate and projecting systems. The cells of the prostrate system are dotted; Fig. 7.—Cells of the prostrate system; Fig. 8.—An empty cell from which a zoospore had escaped; Fig. 9.—Akinetes; Fig. 10.—A rhizoid.

All figs. are × 220, excepting 5 and 10 which are × 245.

rounded. They are on the average 7–14 μ in diameter. Very probably the cells of the prostrate system serve the function of perennation, and in the samples collected in the dry

month of June, it was found that these cells had developed into akinetes with thick stratified walls and contents of a homogeneous nature (Fig. 9).

Rhizoids.—Rhizoids usually arise from the cells of the prostrate system (Figs. 2 and 5). In some cases it was found that the lower cells of the projecting system were directly prolonged into long rhizoidal cells (Fig. 10). In some cases the rhizoids are 1–2 celled, while in others, they are fairly long many-celled structures. Rhizoids are so closely attached to brick-particles, that it is very difficult to detach them. When first examined they escaped notice, as they get mutilated when the alga is scraped. Upper cells of the rhizoids usually contain fragments of chloroplasts, while lower cells are usually hyaline.

Some of the cells of the projecting system were found empty, and an apical cell was found ruptured (Fig. 8), possibly due to the escape of zoospores. However no zoospores were actually observed by the author.

Aplanospores.—In some cells of the projecting system, it was seen that the contents had rounded off into spores which may be described as aplanospores. May be these are arrested zoospores which have developed thick walls, as seen in certain species of *Œdogonium*.

In its structural organization *Iwanoffia* stands midway between *Stigeoclonium* and *Fritschiella*, and marks an important stage in the conquest of land by algal pioneers.

M. S. Randhawa.

2, Park Road,
Allahabad,
September 18, 1940.

Occurrence of *Sclerospora graminicola* (Sacc.) Schroet. on *Setaria verticillata* Beauv. in Allahabad

Among the downy mildews *Sclerospora graminicola* (Sacc.) Schroet. is well known in India as the cause of the green ear disease of bajra (*Pennisetum typhoideum*) which, according to Mitter and Tandon[1] may damage up to 45 per cent. of the plants in low-lying fields in Allahabad. Butler and Bisby[2] record this parasite on only one other host, *viz.*, *Setaria italica*, besides bajra. We have observed this fungus growing on *Setaria verticillata* Beauv. in a shady plot in the University Botanical Gardens and we believe it has not been recorded before on this host in India. So far only the conidial stage has been found. Amongst the plants growing in the garden most of the leaves are attacked. The infected areas soon turn brown and wither. A detailed description of the parasite on this host will shortly follow.

J. H. Mitter.
A. K. Mitra.

Department of Botany,
University of Allahabad,
September 7, 1940.

[1] Mitter, J. H., and Tandon, R. N., *Journ. Ind. Bot. Soc.*, **9**, 243.

[2] Butler and Bisby, *The Fungi of India*, 1931, p. 7.

Note on Sorghum Stapfii. C.E.C. Fischer

Sorghum Stapfii. C. E. C. Fischer is a wild grass native to India. Hooker[1] described it as *Andropogon Stapfii.* Index Kewenisis Supplt. II (1886–1900) gives this plant the status of an independent species. Gamble[2] classified it under the genus *Sorghum.* This plant has not been mentioned by Snowden[3] in his "Cultivated Races of Sorghum".

The chromosome number of this plant as counted in meiosis is $n = 10$. The meiosis is regular. The chromosomes are rather small.

It is interesting to note that *S. Stapfii* easily hybridizes with *S. sudanense* Stapf. and in the progeny of the hybrid segregations occur for both types of plants. *S. sudanense* as also *S. arundinaceum* Stapf., *S. verticelliflorum* Stapf. and *S. æthiopicum* (Hack) Ruper. ex Stapf. are considered by Snowden (*l. c.*) to be primarily concerned in the evolution of the cultivated sorghums. *S. sudanense* hybridises easily with cultivated sorghum [*S. dochna* Forsk. Snowden and also with *S. virgatum* Stapf. Snowden (*l. c.*)] *S. Stapfii* thus forms yet another wild sorghum with which *S. sudanense* hybridizes easily.

It seems reasonable therefore that *S. Stapfii* should find a place in the series *Spontanea* of the Sub-Section *Arundinacea*, of Snowden.

N. KRISHNASWAMY.
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Agricultural Research Institute,
Coimbatore,
September 17, 1940.

[1] Hooker, J. D., *Flora of British India*, 1897, **7**, 184.
[2] Gamble, J. S., *Flora of Madras*, 1934, **10**, 1735.
[3] Snowden, J. D., *The Cultivated Races of Sorghum*, 1936.

On the Natural History of *Rastrelliger kanagurta* (Russell) with Special Reference to its Spawning Season and Eggs.*

THE first description of the South Indian mackerel was by Russel in his *Fishes of Vizagapatam*[1] published in 1803. As his name '*Kanagurta*' was an adaptation from the vernacular, many of the subsequent authors adopted Rupell's specific name 'microlepidotus'. Jordon and Dickerson[2] in 1908 distinguished the chub-mackerel *Rastrelliger* with its deeper body, larger scales, feebler dentition and feathery gill-rakers from the typical mackerel and established the genus *Rastrelliger* for it. As the South Indian mackerel presents these characters, it should be included in the genus *Rastrelliger*. As Russell's names have now been generally accepted, we have called the common South Indian mackerel *Scomber microlepidotus* of Day, *Rastrelliger kanagurta* (Russell).

According to H. W. Fowler[3] this species is widely distributed in the Indo-Pacific region. On the West Coast of the Madras Presidency the seasonal fishery of this fish is of great economic value, and ranks next only to that of *Sardinella longiceps*, the Indian oil-sardine. The statistics collected by the Madras Fisheries Department show that, in a good season like that of 1928–29, as much as about 21 lakhs of maunds (= 75,267 tons) of this fish valued approximately at 27 lakhs of rupees is taken on the coasts of the Malabar and South Kanara Districts (250 miles). The fishery usually commence in August and continues to the end of May; it reaches its peak in October, November and December. As the mackerel taints quickly, the quantity consumed in the fresh condition is not considerable; the great bulk of the catches is cured and the product exported to the interior districts in India and to Ceylon and Singapore. The fishery is subject to great fluctuations as the mackerel fisheries elsewhere in the world. In some years the abundance of the mackerel seems to coincide with the scarcity of the oil-sardine and *vice versa*. As both are plankton-feeders, it is obvious that they both compete for food in a mutual struggle for existence and otherwise affect each other's welfare in a manner not yet intelligible. Over 5,000 specimens have been examined from 1934.

Size: Specimens of this mackerel less than 10 cm. in length have not been met with in the catches examined. 25 cm. is the maximum length to which this fish grows on the west coast as recorded by Day.[4] The fish attain maturity at about a length of 19 cm. The size forming the bulk of the commercial catches varies from 20 cm. to 23 cm.

Food: The diet of this mackerel consists entirely of plankton. The following organisms have been found in its stomach contents.

Zooplankton: (1) Copepods chiefly *Paracalanus* sp., *Euterpina* sp., *Acartia* sp., and *Oithona* sp.; (2) Larval bivalves; (3) Evadne; and (4) Larval prawns.

Phytoplankton: (1) *Conscinodiscus* chiefly *C. jonesianus, C. oculosiridis, C. gigas* var. *dioramma*, and *C. joneschii*; (2) *Peridinians—P. depressum* and *P. ovatum;* (3) *Fragilaria*; (4) *Ceratium—C. tripos* and *C. massiliense*; (5) *Thalassiothrix nitzschioides*; (6) *Nitzschia* sp.; (7) *Asterionella japonica*; (8) *Rhizosolenia*; (9) *Pleurosigma*; (10) *Dinophysis homunculus*; (11) *Biddulphia sp*; (12) *Planktoniella*; (13) *Ceratulina*; and (14) *Tintinnus*.

Its European relative, *Scomber scombrus* is said to include in its dietary small sprats and pilchards.[5] Till now no vertebrate material has

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been seen in the stomach-contents of the Indian mackerel. Usually copepods preponderate showing that this is its favourite item of food.

Spawning Season: Recovering spents are usually met with in September when gonads begin to refill and grow. The maturation of the testis proceeds more rapidly and is much in advance of that of the ovary. Simultaneously with the progress in size of the gonads a corresponding decrease in the catches is noticed, and by the end of May the catches dwindle. As the spawning of this fish synchronizes with the outbreak of the South-West Monsoon and as fishermen don't venture out to sea to fish during the monsoon, any research work on the spawning of the mackerel is bound to be extremely difficult without a sea-going research vessel. The data collected relate to catches which are made occasionally during the breaks in the monsoon. Recovering spents and maturing individuals are abundant enough from September onwards but when they are in a condition preparatory to spawning in May, the mackerel becomes scarce and ultimately disappears under cover of the South-West Monsoon eluding all attempts at research on their eggs and early stages. It is possible that they recede from coastal waters which during this period is much disturbed by the rough winds and rain caused by the onset of the South-West Monsoon. This is favourable to the propagation of the species as ripe individuals which escape the nets go beyond the fishing zone of the fishermen and thereby get a good chance to spawn unmolested by man. Fish in spawning condition are therefore difficult to secure. Besides they appear to spawn at night; but as no spent-fish are found in the day-catches it may be inferred that mackerel either do not spawn in inshore waters exploited by the local fishermen or after spawning at night, they retire beyond their reach. The appearance of spent ones in occasional catches made in August 1937, indicates that the fish after spawning do not permanently retire to the deep sea but seek coastal waters and that their spawning grounds are not very far from the coast.

The above observations roughly show that the spawning of mackerel begins sometime about June and continues till about the end of September, rather a long period.

Eggs: According to Delsman[6] the diameter of the eggs of *Rastrelliger kanagurta* varies from 0·85 mm. to 0·95 mm. The diameter of the preserved eggs measured by us varies from 0·54 mm. to 0·70 mm. It is presumed that Delsman measured fresh eggs. The plankton containing the egg is usually preserved in the boat in 5 per cent. sea-water formalin as otherwise the eggs will disintegrate on the return journey of 4 to 5 miles in an open boat under a tropical sky. Delsman had a power-boat fitted with a laboratory and he studied the eggs very often at the spot where they were collected. The somewhat smaller diameter of the eggs noticed by us, in all probability is due to the eggs having shrunk in preservation. The average number of eggs in the South Indian mackerel is nearly 94,000. On one occasion on 1st June 1937, mature and transparent eggs were obtained from fully ripe individuals and artificial hatching was tried but did not meet with success. Delsman remarks as follows:

"A characteristic feature of the '*Kembung*'† eggs is that they are fairly difficult to hatch. When isolated in a glass with clear sea-water a good many of them die in the course of the day and sink to the bottom, becoming opaque. As a rule only a few hatch. This occurs in the course of the evening between 4 and 6 p.m."

In a haul of shore plankton taken at a distance of 5 miles from the shore off Calicut (Chaliyam) on 5th June 1937, at a spot where mackerel were being caught, there were mackerel eggs of the sizes and characteristics of those obtained on 1st June 1937 from full mature specimens. 405 eggs were collected in different stages of development beginning with eggs just fertilized and ending with those with larvæ ready to hatch out. There were also just hatched larvæ. The eggs which were undoubtedly mackerel eggs occurred in a spot where ripe mackerel shoaled and as the fertilised eggs closely resembled in size and

† *Kembung lelaki* is the local vernacular name given by Delsman for *Rastrelliger kanagurta*.

character those obtained from a spawning mackerel, it seems certain that the eggs in the plankton were those of the mackerel. Dr. Delsman also identified mackerel eggs in the plankton in the Malay Archipelago by a process of elimination and inference. In the absence of artificially fertilized eggs, the inference lacks that conclusiveness which was obtained for the eggs of the oil-sardine in 1934 (*vide* paragraph 11 of Administration Report of Department of Fisheries for the year 1934–35). This conclusive proof can only be furnished when spawning fish are secured and artificial fertilization is carried out.

Internal Parasites: These are found in the pyloric coecæ, the gut and in the peritonium covering the gut. The parasites in the pyloric coecæ and the gut are numerous and appear to be free scolices of tapeworms or metacestodes. Those found imbedded in the peritonial tissue or sometimes free in the body-cavity are just a few not exceeding two or three in one specimen and are fully developed milk-white tapeworms.

The presence of free scolices in the mackerel indicates that it is the intermediate host of an adult tapeworm or tapeworms and therefore forms the food of predaceous animals such as sharks, perpoises, etc., among whom one should expect the permanent host, whereas the presence of a fully developed tapeworm shows that the scolices must have found their way into the body through the food of the mackerel. In the former case or perhaps in both cases, one might trace possible causes for the natural fluctuations of this mackerel.

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[1] Russell, *Fishes of Vizagapatam*, 1803, **2**, 28, pl. 136.
[2] Jordon and Dickerson, *Proc. United States National Museum*, 1908, **34**, 607.
[3] Fowler, H. W., *The Fishes of Oceania*, 1928, p. 132.
[4] Day, *The Fauna of British India: Fishes*, 1889, **2**.
[5] Cunningham, J. T., *The Natural History of the Marketable Marine Fishes of the British Islands*, 1896.
[6] Delsman, H. C., *Treubia*, 1926, **8**, 395.

The Apodan Sperm

The Sperms of Amphibia are of two types. The anuran type is very different from the urodelan type and is, curiously, the simpler. In the former, the head is followed by a short but conspicuous neck region in which, in the majority of forms, both the centrioles are lodged. A portion of the base of the flagellum is ensheathed by the mitochondria which are disposed in a spiral manner. This region is usually called the "middle piece" (Wilson, 1928). The structure of the urodele sperm, on the other hand, is highly complex and is very different from that of the Anura. Of the two centrioles, the proximal or head centriole becomes greatly enlarged and conspicuous as a rounded, ovoid or elongated body closely applied to the head of the sperm. Gatenby (1931) finds a clear non-staining space between the head and the proximal centriole in the sperm of *Desmognathus fusca*. The distal centriole, on the other hand, undergoes a curious modification. It becomes converted into a ring which greatly elongates and often extends backwards in the form of a long pessary through a considerable distance along the tail.

Nothing is known of the spermatozoa of the third group of Amphibia, the Apoda. The Sarasins (1890) figured the sperms of *Ichthyophis glutinosus* but their observations are by no means complete and in a review of the subject of the structure and development of the animal sperm, Ballowitz (1913) denies all knowledge of the sperms of Apoda.

In the course of my studies on the spermatogenesis of Apoda, I have had opportunities of examining the sperms of *Ichthyophis*, *Uræotyphlus* and also *Siphonops* which I describe below.

Figs. 1, 2 and 3 show the ripe sperms of *Ichthyophis glutinosus*, *Uræotyphlus narayani* and *Siphonops annulatus*. They have been drawn at the same magnification. A variation in the size of the head is noticeable in the three species. The acrosome is spatulate and

though slightly variable in size in the three species, is of similar appearance.

But it is the post-nuclear region that is of great interest. In this respect the apodan

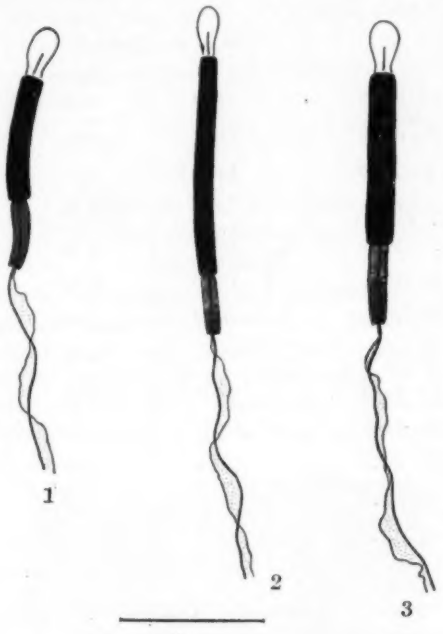

Fig. 1.– The sperm of *Ichthyophis glutinosus*. Fig. 2.—The sperm of *Uraeotyphlus narayani*. Fig. 3.—The sperm of *Siphonops annulatus*.

sperm resembles that of the Anura. Both the centrioles are found close behind the nucleus. The proximal centriole becomes flattened and is closely applied to the nucleus. Very often it is so deeply stained that it is indistinguishable from the nucleus. But in Flemming and other chrome-osmium fixatives its presence is clearly revealed and a non-staining area separates the two. The distal centriole, after giving off the axial filament also travels anteriorly and fuses with the base of the nucleus. There are no indications of the elongation of either of the centrioles to form the compact deeply staining body (proximal centriole) or the greatly produced ring (distal centriole) of the urodele sperm. In respect of the disposition of the centrioles, therefore, there is a close similarity between the apodan and anuran sperms.

In regard to the disposition of the mitochondria also there appears to be a striking resemblance. It is known that in Anura, the mitochondria occur at the base of the flagellum, occupying a longer or shorter region in the form of a spiral sheath. The question of the presence of mitochondria in the urodele sperm is still unsettled but the recent work of Gatenby (1931) would appear to show that while mitochondria may occur scattered here and there around the nucleus, their aggregation to form a distinct post-nuclear region is not seen. In the apodan sperm there is a distinct sheath of mitochondria around the base of the flagellum recalling the condition found in Anura. All the three species exhibit it (see Figs.). But the mitochondria do not show the spiral disposition described in Anura.

In all the three species, the tail is provided with an undulating membrane which is continued along the greater part of its length.

I am thankful to Prof. A. Subba Rau for placing two magnificent specimens of *Siphonops annulatus* at my disposal.

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Ballowitz, E., *Handwörterbuch der Naturwissenschaften*, 1913, **9**, 251.

Gatenby, J. B., *Journ. Morph.*, 1931, **51**, 597.

Sarasin, P. & F., *Erg. der Naturwissenschaft auf Ceylon, Wiesbaden*, 1890.

Wilson, E. B., *Cell in Development and Heredity*, Macmillan, New York, 1928.

Mixed Cropping and the Cotton Root Rot Disease (*Macrophomina phaseoli* and *R. Solani*)

THE growing of cotton mixed with another crop has been practised for long in India and other tropical countries. In the Punjab, a leguminous or other crop is often sown with cotton for use as fodder. Recently the investigation of benefits of mixed cropping has been taken up in some stations; it is in progress at Rothamsted. But the effect of mixed cropping on the incidence of diseases has not been fully studied. Some experiments have been conducted on this subject at Lyallpur in relation to the root rot disease of cotton.

The experiments were conducted in a field which was heavily and uniformly infected with the disease. Mollisoni 39—an indigenous cotton—was sown in May, at the optimum time for the appearance of the disease, with a view to provide conditions favourable for a vigorous attack of the disease. Sorghum J. 20 was broadcasted on the same day in between the rows of cotton. A border of 2 feet was also sown with sorghum all round the cotton crop. Another set of plots was sown with pure cotton to serve as controls. The plots were arranged in randomised blocks replicated four times. Weekly counts of mortality due to root-rot were made both in the mixed and pure cotton plots. Records of air temperature, soil temperature (at 30 cm. depth) and humidity were taken twice a day, i.e., at 8 a.m. and 5 p.m. The sorghum crop was removed on the 16th of August.

The figures for the average per cent. mortality from week to week in the mixed and pure cotton plots are given in the table.

Total mortality throughout the season was 3·4 per cent. in the mixed plots as against 68·5 observed in the pure cotton control plots.

The results recorded in the above table show that mortality in the mixed crop is significantly lower than in pure cotton throughout ($t = 5·36$). Soil and air temperatures were lower in the mixed crop while humidity was higher.[1]

Root-rot mortality in mixed and pure cotton plots

Week ending	Per cent. mortality	
	Cotton only	Cotton + Sorghum
20—6—39 ..	7·67	0·83
26—6—39 ..	12·47	0·34
3—7—39 ..	10·84	0·16
10—7—39 ..	4·84	0·08
17—7—39 ..	10·47	0·00
24—7—39 ..	12·10	0·00
31—7—39 ..	5·72	0·00
7—8—39 ..	12·47	0·00
14—8—39 ..	3·21	0·00
21—8—39 ..	2·12	0·00
30—8—39 ..	1·78	0·00
4—9—39 ..	1·20	0·00
11—9—39 ..	2·23	0·09

In another experiment, Desi cotton (variety Mollisoni 39) was sown on 14th of May, and Moth (*Phaseolus aconitifolius*) was sown between the cotton rows on the same day. A border of the same crop was also sown around cotton. Three plots were sown with mixed crop and the same number was put under pure cotton as checks. Along with root-rot mortality counts, soil and air temperatures were also recorded. The temperatures were lower in the mixed crop than in the pure and humidity was higher in the former. The mortality in cotton with moth was lower than in pure cotton, the difference being highly significant. It was further found that in the plots where moth was mixed with cotton, the root-rot mortality occurred during the first fortnight only and that too on spots where moth crop was thin. It will be seen that raising cotton either with sorghum or moth will reduce the incidence of root-rot disease. Moth is, however, more

suitable than sorghum, as it neither shades nor affects the growth of cotton plants.

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[1] Vasudeva, R. S., *et al.*, *Ind. J. Agric. Sci.*, 1939, **9**, 595.

A Note on the Occurrence of Tri-Cotyledonary Seedlings in *Crotolaria juncia* Linn.

DURING the course of an investigation now in progress, seedlings of *Crotolaria juncia* were raised in the garden attached to the Bose Research Institute. Seeds were supplied by the Fibre Expert to the Government of Bengal, Dacca. Number of cotyledonary leaves in the seedlings were ordinarily two but few showed abnormal number of three cotyledons. It was found that multiplication of cotyledons in *C. juncia* were of frequent occurrence in the sample of seeds used during investigation. Seedlings which were subsequently raised at the Falta sub-station of the Institute also showed abnormality in the number of cotyledons. Out of 760 seedlings eight seedlings had three cotyledonary leaves. None of the cotyledonary leaves showed any sign of external distortion or splitting and were arranged symmetrically in a whorl.

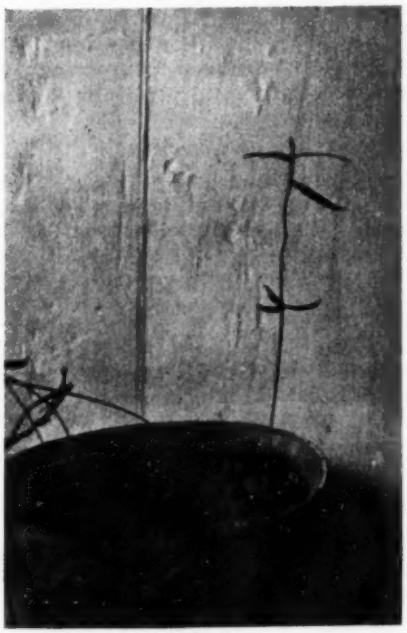

FIG. 1

Photograph of a seedling of *Crotolaria juncia* showing three cotyledons. × 1/3.

Multiplication of cotyledonary leaves have been noted in few angiosperms: *Acer pseudoplatanus*, *Cheiranthus cheiri*.[1] Abnormal number of cotyledons (3–5) have been noted in *Correa*, *Cratægus*.[2] Tri-cotyledonary seedlings have been noted in *Apium pteroselium* and few species of *solanum*.[2] In *Crotolaria juncia* faciation of inflorescence axis and of stem have only been noted.[3] Progenies of the tri-cotyledonary seedlings will be studied in the next generation and a detailed account will be published later.

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[1] Worsdell, *Principles of Plant Teratology*, 1915, **2**, 215.

[2] Masters, *Vegetable Plant Teratology* (*Lond. Roy. Soc.*), 1868, 370.

[3] T. C. N. Singh, *Journ. Ind. Bot. Soc.*, 1930, **9**, 250.

On the Origin and Distribution of Cloud Charges

OF the two important theories advanced to explain the production of electrical charges in thunder clouds, *viz.*, the "breaking drop" theory of Simpson and the "ion capture" theory of Wilson it has not yet been decided which is the process really in operation. It is generally considered that perhaps both are in operation. Simpson's theory[1] predicts negatively polarised clouds and Wilson's theory[2] predicts positively polarised clouds. In practice both are

observed. The observations of Banerji[3] in India are in accordance with Simpson's theory. Observations by other investigators[4,5] in England and Africa show a preponderance of positively polarised clouds. Recent balloon observations of Simpson[6] and field measurements of Wormell[7] in England confirm the preponderance of positively polarised clouds in that place. Hence the idea is gaining ground that the Wilson process is the more effective one in the formation of cloud electricity.

In the interpretation and discussion of the results one important factor seems to have been ignored. This is the influence of impurities in the water of clouds.

The purpose of this note is to point out the possibility of the formation of positively polarised clouds even by the Simpson mechanism. For this it is necessary to point out certain experimental results of J. J. Thomson[8] on the breaking of water drops in air. While distilled water develops a positive charge it was found that very small amounts of certain impurities dissolved in it entirely reverse the effect, the drops acquiring a negative charge. Thus Thomson gives the following results: 0·2 c.c. of H_2SO_4 in 1,000 c.c. of distilled water reverses the effect. A drop of hydrogen peroxide or methyl violet and other organic compounds not only reverses the effect but the amount of negative charge per c.c. is two or three times greater than the positive charge produced in distilled water.

Simpson developed his theory on the assumption that the water of the drops was pure. But if the drops of a cloud contain traces of impurities then there is an explanation of clouds with negative bottoms produced by Simpson's mechanism. In this connection it is interesting to point out the investigations of Schwend (quoted by Simpson[1]) on individual rain drops, which showed a marked mixing of drops having positive and negative charges. This seems to show that the kind of charge developed depends on the nature of each drop, perhaps the nature of the nucleus on which it condensed.

The important observation that the negative fields under positively polarised clouds are more intense than the positive fields under negatively polarised clouds can be explained by Thomson's observation that traces of some organic compounds as well as hydrogen peroxide greatly enhance the electrification in addition to reversing it. The large amount of charge in negative rain may be due to this also.

Now the chances of impurities likely to produce such effects are greater near cities and over oceans. This has some connection with the observation of Nukiyama and Noto[9] in Japan that in general coastal storm clouds have the Wilson distribution while the Simpson type is predominant in inland clouds. Hence the situation of a station seems to determine the polarity of clouds over it.

It is probable that the formation of traces of hydrogen peroxide may be the chief cause for the predominance of positively polarised clouds. The formation of hydrogen peroxide has been detected in rain. Besson[10] has shown its existence together with ozone in the heavy drops of rain as also in spray and evaporating water. Chlopin[11] found hydrogen peroxide in moist air exposed to ultra-violet radiation. Thus it seems that Simpson's mechanism will largely produce positively polarised clouds unless there are impurities which will destroy hydrogen peroxide. Hence it will be profitable to analyse rain water at various stations to see whether or not sufficient quantities of the above impurities exist to explain the reversal.

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September 17, 1940.

1 Simpson, G. C., *Proc. R. Soc.*, (A), 1926, **114**, 376.
2 Wilson, C. T. R., *J. Frank. Inst.*, 1929, **208**, 1.
3 Banerji, S. K., *Phil. Trans. R. Soc.* (A), 1928, **231**, 1.
4 Wormell, T. W., *Proc. R. Soc.*, (A), 1927, **115**, 445.
5 Schonland, B. F. J., *ibid.*, 1928 **118**, 233.
6 Simpson and Scrase, *ibid.*, 1937, **161**, 309.
7 Wormell, T. W., *Phil. Trans.*, 1939, **238**, 249.
8 Thomson, J. J., *Phil. Mag. Sc.* 1894, **37**, 341.
9 Nukiyama, D., and Noto, H., *Jap. J. Astr. Geophys.*, 1928, **6**, 71.
10 Besson, A., *C. R.*, 1911, **153**, 877.
11 Chlopin, W., *Zeit. Anorg. Chem.*, 1911, **71**, 2198.

REVIEWS

Cosmic Rays. By R. A. Millikan. (Cambridge University Press, London), 1939. Pp. 134. Price 8*sh.* 6*d.*

This book is based on the lectures delivered by Prof. Millikan at Virginia in 1936 and at Dublin in 1937. The material, however, has been brought up to the date of publication in 1939. Though it deals largely with the work done by the cosmic ray group at the Norman Bridge Laboratory in Pasadena, the important conclusions arising out of the work of other schools are also considered.

The first few pages of the book are devoted to answering also the question "What are cosmic rays good for?", and incidentally also to some comments on world-affairs not wholly unconnected with the subject of the book. An excellent historical treatment of the growth of knowledge about electromagnetic radiation then follows. Starting from the earliest work of Gockel, Hess and Kolhorster, Professor Millikan gives a lucid account, not only of the subsequent results but also the reasoning by which they were reached. And in this treatment the frankness of the author is refreshing, specially with regard to his own work on the world survey of cosmic ray intensities. One can see evidence in almost every page of the rare experimental skill and unlimited perseverance of Prof. Millikan. His description of the Neher electroscope is a fine example of how closely the growth of knowledge in this field has been the result of new experimental techniques.

The various geomagnetic effects have been qualitatively treated and the conclusions that can be drawn from the experimental results about the primary cosmic ray spectrum, the nature of the particles and their probable origin have also been mentioned as far as our present knowledge permits. The cloud-chamber technique for photographing and measuring the energies of the cosmic ray particles has been described, and an account is given of the discovery of the positron. A non-mathematical treatment of the various processes of energy loss of charged particles traversing matter is given, as also a description of the cascade theory of shower production. In the text, this theory is attributed to Bethe and Heitler; actually, however, it was the paper of Bhabha and Heitler (1937) which first explained showers by a successive application of the phenomenon of Bremsstrahlung and pair creation. It might also be mentioned that statement 7 on page 54 might suggest that this process of shower production continues 'until the energy is all degraded into a very large number of lower and lower energy photons and electrons'. Actually, the loss by ionisation becomes the more important as soon as the energy falls below a critical amount depending on the nature of the matter traversed. (For air, this is about $1{\cdot}3 \times 10^8$ electron volts.)

The treatment of the meson component of the cosmic radiation in this book is rather inadequate. This was, however, inevitable as this part of the subject has been quite a recent development. C. V. RAMAN.

Annual Review of Physiology. By James Murray Luck and Victor E. Hull. (American Physiological Society and Annual Reviews Inc., California), 1939. Pp. v + 705. Price $5·00.

This is a new and welcome publication which has undertaken the difficult and responsible task of surveying the year's advances in the field of physiology. The success of such an enterprise depends upon the extent of willing co-operation of the foremost workers in the field, which the editors of the Review would be able to elicit and in the present instance, we may feel confident that under the editorship of Dr. Luck, who has a genius for organising such publications, these annual reviews will have a long and brilliant career of sustained excellence and usefulness.

The present volume covers practically every aspect of physiology; the energetics of physiological processes, the functioning of the vital organs and the tissues of the body and the physiology of the special senses, and the endocrine glands are all included. The volume has reviews on the progress of applied physiology and psychology. The field covered by the publication is thus wide and comprehensive.

We share with the editors the hope that "this new review will supplement the invaluable service which has been rendered for many years by *Physiological Reviews* and the *Ergibnisse der Physiologie*". The Annual Review is proposed to serve a somewhat different object; to give a broad resume of the significant work in the entire domain of physiology.

The Annual Review, by the very nature and variety of topics discussed, will attract the attention of a wide circle of scientific workers and we have every hope that this new venture will be crowned with the same degree of success which has attended the *Annual Review of Biochemistry*. M. S.

Chemicals of Commerce. By F. D. Snell and C. T. Snell. (Chapman & Hall, Ltd., London), 1940. Pp. viii + 540. Price 28*sh*.

This book is a useful descriptive compilation of classified commercial products of common or relatively common use though I rather doubt the suitability of calling many of them, *e.g.*, rubber, petroleum, etc., "chemicals". The field covered is wide but a comprehensive selection has been made and arranged in thirty-eight chapters, each of which deals with a different group of commercial substances, the individual specification of which is preceded by a general outline of the characteristic properties of the group.

In general, the book appears to me to be more particularly suited to the American reader, as U.S.A. standards, particularly U.S.A. pharmacopeial standards, are so frequently mentioned and the definition of proof strength is not that used in Great Britain or India, but there can be no doubt of its utility to the chemical profession.

I appreciated some sections of the book more than others and, in particular, the chapters giving information on Extracts of Natural Products, Essential Oils, Perfumes and similar classes, of which the authors seem to have a specialised knowledge and provide much information which it is frequently difficult to find. The arrangement of the items in these chapters as also in the tables given on pages 316–17, 428–29 and elsewhere could be improved while from that excellent feature, Appendix B, which 'translates' medical terms used in the text, I missed cathartic, echolic, excipient, genitourinary, laxative, nutrient, sternative and styptic.

In some instances, the information given does not appear to be quite up to date. For example, there is no mention of liquid hydrofluoric acid, buna, sulphurised oils, perchloron, maxchlor or power alcohol while the identity of tecsol, agdite, pontol and hydronol might have been very useful to advisory chemists in any country experiencing difficulty in the matter of denaturants for alcohol, and a chapter on commercial solvents with their trade names, such as Westron, Westrosol, Dekalin, would have been welcome and a wider selection of new synthetic drugs would have appealed to certain classes of chemists.

I found it difficult to reconcile myself to such loose statements as the description of the ternary azeotropic mixture of alcohol, benzene and water, as a compound; chromium as both acidic and basic in its properties and the statement that no water is formed in the reaction of acetic anhydride with cellulose. Among technical errors observed were the value of ammonium nitrate in explosives, the action of carbon on barium sulphate and the definition of mortar.

The paper and printing are excellent though the splitting of words in the form, potas-sium, hy-droxide, hydrol-ysis, pred-ict and neces-sary, strike one strangely. There are singularly few spelling mistakes but I would invite attention to cocoa for Coca and propionic for propiolic and a few similar errors which might cause difficulties. Among the few incorrect formulas may be mentioned BaOH, $8H_2O$, the sodium molybdates and tungstates, orpiment which is As_2S_3, not As_2S_2, $(CH_3)_2C_6H_4OH$, $NH_2C_6H_9NHOCCH_3$ and $HOC_6H_4(NO_2)Cl$. Much repetition could have been avoided by a general statement to the effect that *o*-, *m*-, *p*- meant ortho, meta and para and α and β, alpha and beta. In some cases, the orientation of cyclic compounds is indicated and omitted in others, *e.g.*, T.N.T. and sodium picramate. I doubt if morpholine can be described as structurally similar to ethylene diamine.

As similar chemical dictionaries have appeared recently, I examined this work with great care but, although I have made rather a detailed criticism, it must not be concluded that there is not much of value in the work, including a considerable amount of newly classified information. It

seems to me, however, that the authors appear to have attempted rather too much in the compass of a single book and I feel that, in future editions, an expansion of each chapter and the addition of new ones will be found necessary until the work ultimately has to appear in several volumes.

My view, therefore, is that "Chemicals of Commerce" will prove valuable to professional chemists rather as an addition to the shelves of their libraries than as a comprehensive book of reference summarising the type of information suggested in its title.

H. B. DUNNICLIFF.

Phenomena at the Temperature of Liquid Helium. By E. F. Burton, H. Grayson Smith and J. O. Wilhelm. (Reinhold Publishing Corporation, New York; Chapman & Hall, Ltd., London), 1940, Pp. xi + 362. Price $6.00.

In this book written for the American Chemical Society, Professor Burton and his colleagues of the McLennan low temperature laboratory of the University of Toronto give us a survey of all the work done at low temperatures till April 1939. The book is divided into eleven chapters. Four chapters are devoted to the low temperature technique, to explain how these low temperatures are produced and the method employed in measuring them. For a time, some theoretical calculations raised serious doubts whether the extreme low temperatures recorded (0·005° Curie) in adiabatic demagnetisation experiments were really attained. The mathematicians calculated on certain assumptions the probability for the transition of a quantum of magnetic energy into a quantum of thermal energy. This probability gives the time taken by the magnetic ions to be in equilibrium with the temperature of the crystal lattice. Fortunately for the experimenter he was able to determine these times experimentally and thus succeeded in showing that the calculations are wrong by a multiplying factor which is of the order of one thousand, and that the low temperatures recorded are really attained.

Four more chapters are devoted to describe the interesting phenomena of superconductivity and the peculiar properties of liquid helium. From the entropy temperature diagram between 0° and 4° K it is inferred that in the superconducting state the electrons contribute to the entropy as if they were the atoms of a solid, that is, as if they were reduced to an ordered configuration, and it is suggested that this order would probably be a regular distribution of velocities rather than a regular arrangement in position. The remaining chapters deal with our present ideas about the thermal and electrical conductivities, about magnetism and about specific heats. These we believe are included to make the book complete in itself and are presented in a way which is different from the routine and is yet original and simple. For example, the authors make a clear distinction between the contributions to the specific heat, of atomic and molecular vibrations (Debye), of atomic and molecular excitation (Schottky), of co-operative phenomena (Bragg-Williams and Bethe), and of conduction electrons in a metal (Sommerfeld).

The theoretical part of the book will be intelligible to anybody familiar with the principles of thermodynamics and of elementary quantum theory. There is also an exhaustive bibliography with about 700 references. The book can be read with advantage as an introduction to low temperature physics.

K. R. DIXIT.

Calculations of Quantitative Analysis. By Carl J. Engelder. (John Wiley & Sons, New York; Chapman & Hall, Ltd., London), 1939. Pp. vi + 174. Price 12*sh.*

In an exact science like analytical chemistry, the theoretical principles and concepts can be reduced to mathematical terms, and hence the calculations involved in applying theory to practice constitute a very essential part of the study of quantitative analysis. The book under reference aims at covering and supplementing the usual course of elementary quantitative analysis with a set of graded problems. There are fifteen sets of twenty problems each, with correct final answers supplied for alternate problems only, this latter in order that the student can check for himself the correctness of his method of solution of problems. Each set of problems is preceded by a concise account of the theory and a few typical calculations.

The book is divided into four parts. Part I deals with introductory considerations, arithmetical operations and reagents in general. Part II which covers nearly half of the

book deals with calculations in volumetric analysis, including acidimetry and alkalimetry, volumetric precipitation analysis, and oxidation-reduction processes. Part III takes up the calculations involved in gravimetric technique, and Part IV concludes with the applications that are made of analytical data obtained by either volumetric or gravimetric methods.

Both teachers and students will find the book a helpful companion for the B.Sc. course. C. R. V.

Spectroscopy and Its Applications. *Proceedings of the Seventh Summer Conference on Spectroscopy and its Applications*, held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, July 17–19, 1939. (John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London), 1940. Pp. viii + 154. Price 16*sh.* 6*d.* net.

In this book we have a number of papers (twenty-eight to be exact) contributed by various authors to the Seventh Summer Conference of Spectroscopy and its Applications, called together by Prof. G. R. Harrison and held at the Massachusetts Institute of Technology. The papers deal mostly with the ever-widening field of application of spectroscopic methods. The extraordinary range of applications will best be appreciated by perusing the "alphabet of spectroscopy" given on pp. 7–9 of the book. There are papers dealing with the speed and accuracy of routine analyses carried out in several industries, *e.g.*, steel analysis at the Ford Company, analysis of ceramic materials, estimation of small traces of elements in fertilizers, determination of lead in blood and so on. Other papers deal with the sources, the dispersing instruments and the apparatus for the measurement of intensities, which is at the basis of quantitative spectrochemical analysis. Biological applications are covered by a number of papers and there is one paper on astrophysical applications. Although the several papers are not logically connected, and do not give a detailed survey of all the methods employed and results obtained, one can get a fair idea of the problems that are being tackled and the methods that are being developed, at first-hand. One could have wished for more details in certain instances and if it had been possible to include a summary of the discussions which the papers evoked, this wish would have been partly fulfilled. However, we must be grateful to Prof. Harrison for making the results of such congresses of specialists available to a much wider public. Here in India, some of the developing industries will profit materially by adopting spectrochemical methods of analysis and we should warmly recommend the book to those in authority in these industries. For the ordinary physicist, we are afraid, the price is too heavy, considering the extremely minute chance he has of obtaining any emoluments from professional consultations. But a perusal of the book will certainly correct the biassed view that much of modern physics taught at the Universities is a mere high-brow disquisition about atoms and quanta, without any fields of useful application. T. S. S.

Mathematical Tables, No. 1. (Statistical Laboratory, Calcutta), 1940. Pp. 30. Price Rs. 2.

These tables contain the values of n^r (for $r = 2, 3, 4, \frac{1}{2}, -\frac{1}{2}, -1$) and of $\log_{10} n$ from $n = 1$ to 1000. The values of $n^{\frac{1}{2}}$, $n^{-\frac{1}{2}}$ and $\log n$ are given to 7 places but those of n^{-1} are given to 9 places. The natural and logarithmic sines, cosines and tangents of angles from 0° to 90° are also tabulated to 7 places, at intervals of 0°·1. The inclusion of a table of values (to 5 decimal places) of e^x from $x = 1$ to 300 at intervals of ·01 is a useful feature. The figures in the last line of each page are repeated again in the first line of the next page; this duplication appears to be superfluous.

Though much of the material in this first number of these tables is easily available elsewhere, in conjunction with the further numbers yet to come and of which presumably the present number is the forerunner, these tables are sure to be of good use to all who have to deal with numerical data. The printing and get-up of the book are quite good. V. R. T.

EXCAVATIONS AT HARAPPA*

THE pre-historic mounds of Harappa are situated in the vicinity of the modern town of Harappa about fifteen miles from Montgomery in the Punjab. These mounds were known to antiquarians since 1826 and were officially reported on by Cunningham in 1873. The ruins had already been exploited for providing brick ballast for about a hundred miles of the Lahore-Multan railway and for bricks for the large number of houses of Harappa town. Steps were taken only in 1920 to protect the site under the Ancient Monuments Preservation Act, but by this time the vandalism of railway contractors had made a mess of the whole site. Systematic excavation of the mounds was begun and continued for three seasons by the late Rai Bahadur D. R. Sahni and afterwards from 1926 to 1934 by Mr. M. S. Vats, Deputy Director-General of Archæology in India, who has now published a most thorough, painstaking, and profusely illustrated monograph on the work done by the Department at Harappa.

Though Harappa lacked the affluence of Mohenjo-daro and its structural remains had been very much disturbed, the excavators were able to dig deeper at Harappa than at the other site, and discover lower strata that contained relics of the early centuries of the fourth millennium B.C. The most interesting of the antiquities from Harappa are the tiny seals and sealings of a very archaic character, from which the animal seals of the Indus civilization are believed to have evolved. Next to them in importance is the great state granary where grain received as taxes was probably stored up. Relics were also found of some palatial houses, with a frontage of over a hundred feet, designed "so as to separate the female apartments from the rest of the house". Wells were rare at Harappa, the inhabitants probably depending mostly on the river for their supply of drinking water. Drainage and conservancy arrangements were throughout the same as at Mohenjo-daro.

In addition to the usual chert implements known at Mohenjo-daro, from one of the early strata of Harappa came a granite celt which showed evidence of having been used. The copper tools were identical with those of Mohenjo-daro. A miniature copper chariot with gabled roof from another early stratum is considered by Mr. Vats to be the first example of a covered chariot from the Indus valley sites "antedating the earliest use of a wheeled vehicle in Egypt by several centuries".

Readers of *Current Science* will be specially interested in the report on the sixteen furnaces discovered at Harappa. None of them is complete, but enough remains to enable the excavator to form an idea of their shape, etc. One furnace was made of a cylindrical pottery jar imbedded in the earth. Others were round or pear-shaped and lined with bricks-on-edge and had vaulted roofs, and there is evidence to show that the ancient metallurgists of Harappa were able to maintain a very high temperature in their furnaces for casting their bronze and copper tools, for firing faience objects and for glazing their steatite seals and vessels. Khan Bahadur Sana Ullah has an interesting chapter on "the sources, composition and technique of copper and its alloys", and from a comparative study of the impurities in them he is able to establish definitely the sources of the metals used at Harappa.

Another outstanding discovery from the point of view of the history of science, is that of a graduated measuring rod of bronze with the divisions averaging about 0·934 cm. From a metric study of the structural remains Mr. Vats comes to the very interesting conclusion that the "Royal Cubit" of 20·7 inches and the foot of 13·2 inches were in vogue at Harappa.

It is of interest to note in passing that Harappa had about seven types of pottery lamps one of which is of the closed Roman type.

In the field of plastic art Harappa has a sensational item for the sceptically minded. It is a small statuette of a nude male, in red sandstone, from stratum III of Mound F. It recalls to mind the art of the Greek sculptors on account of its "wonderfully truthful modelling of the fleshy parts", but Mr. Vats shows very conclusively and beyond any possibility of doubt that this figure is Indian and pre-historic.

The excavators of Mohenjo-daro were regretful that they did not come across any

* *Excavations at Harappa*. By Madho Sarup Vats, M.A. In two volumes with plans and plates. Vol. I.—Text, Vol. II.—139 Plates (Manager of Publications, Delhi) 1940. Price Rs. 50-6 or 77*s*., inclusive of Volume II.

extensive burials at that prehistoric city, for, burials are always psychologically revealing and give us, moderns an inkling into the faiths and beliefs of the dim distant past. Fortunately Mr. Vats discovered an extensive cemetery at Harappa with burials belonging to two distinct types, the earlier ones being what he has termed "earth burials" and the later ones "pot burials". In the mythological scenes painted on the burial jars, Mr. Vats finds many items of Indian beliefs, echoes of which are heard in the Vedas.

A. A.

LORD RUTHERFORD

Rutherford, being the Life and Letters of Lord Rutherford, O.M. By A. S. Eve, with a Foreword by Earl Baldwin of Bewdley. (Cambridge University Press, London), 1939. Pp. 451. Price 21*sh.*

THE Cavendish Professorship of experimental physics at Cambridge was occupied in succession by four outstanding men of genius and worldwide fame, namely, Clerk-Maxwell, Rayleigh, J. J. Thomson and Rutherford, whose work made an uneffaceable impression on science. Clerk-Maxwell was the first incumbent of the chair from 1871 to 1879, but his principal contributions to science were made at an earlier period. Rayleigh who succeeded him resigned in 1884 after a brief tenure of five years. He was succeeded by J. J. Thomson, then a young man only twenty-eight years of age. Both Clerk-Maxwell and Rayleigh were essentially individualists. The fame of the Cavendish Laboratory as a great centre of experimental research really dates from the year 1894 when J. J. Thomson turned his attention to the study of the discharge of electricity in gases. About this time, the University instituted a research degree open to any one who resided for two years and did an original investigation which received the approval of the examiners. The first research student to work under J. J. Thomson under this scheme was a young man from New Zealand who came to England with an 1851 Exhibition scholarship. That young student was Ernest Rutherford, who fittingly enough, succeeded J. J. Thomson twenty-four years later when the latter retired from the Cavendish Professorship in 1919. J. J. Thomson received the Nobel Prize for Physics in 1906, and Rutherford, the Nobel Prize for Chemistry in 1908. Their mortal remains now rest side by side at the Westminster Abbey in London where Britain's greatest men lie buried.

The fascinating story of Rutherford's remarkable life and career is well told in the biography which has been published by the Cambridge University Press. The book has been compiled by a friend and fellow-physicist in the person of Prof. A. S. Eve, F.R.S., who had been associated with Rutherford in the days of his earliest scientific triumphs at the McGill University in Canada and continued in close touch with him till the end. Much of the most interesting part of the book consists of extracts from the letters written by Rutherford himself to his wife and to his numerous friends and collaborators over a period of forty years. The care of Lady Rutherford in having preserved her husband's letters was indeed most fortunate, as they reveal Rutherford's personality in a remarkable way and tell the story of his life far more intimately and vividly than any biographer could have done.

The writer of this review well remembers his meeting Rutherford at the Cavendish Laboratory on the occasion of his first visit to England in 1921, and again on various occasions in 1924 and in 1929. He takes the opportunity of referring with pleasure and gratitude to the generous and friendly spirit manifested by Rutherford in his contacts with the writer. Many of Rutherford's letters to his friends were in his well-known and characteristic handwriting. It was the magnificent personality of Rutherford and his readiness to help the cause of science in every way, quite as much as the greatness of his own scientific work, which evoked the enthusiastic admiration of his colleagues and made him the towering figure he was in the world of science. The story of Rutherford's life and career cannot fail to be an inspiration to all students of science. The volume under review is one which may be heartily commended to every one who is interested in the triumphs of the human spirit in the world of Knowledge.

C. V. RAMAN.

CENTENARIES

Bugge, Thomas (1740-1815)

THOMAS BUGGE, a Danish astronomer, was born at Copenhagon, October 12, 1740. After a course in theology, he devoted himself to mathematics, astronomy, physics and mensuration. In 1761 he made observations on the transit of Venus. In 1777 he became professor of astronomy in the University of his native town. Next year he took charge of the observatory of the Round Tower. In 1798 he was deputed to work with the National Institute of Paris for securing uniformity of measures and weights.

The extreme accuracy of the excellent charts of Denmark, published by the Academy of Sciences, is mainly owing to him. His work on the coastal survey had considerable value. By his careful indication of every coast, harbour, island, rock and sand bank, the navigation of the Danish waters was made quite safe.

Bugge wrote more than a dozen papers of astronomical and geographical importance. The first of these was *Beskriveise over den Opmanlingsmethode som bruges ved de denske geographiske korter* (1779). The most used books of his are *De forste Grunde til den suhaeriske og theorestiske Astronomie, sand der mathematiske geographie* (1796) and *De forste Grunde til den rene ciller abstracte Mathematic* 3 D1. 1813–14.

Bugge died January 15, 1815.

Vigors, Nicholas Aylward (1785-1840)

NICHOLAS AYLWARD VIGORS, a British ornithologist, was born at Old Leighin in 1785. While he was at the Trinity College, Oxford, he wrote his *Enquiry into the nature and extent of poetick licence* which was published in 1810. After seeing military service in the Peninsular War, he qualified himself for the M.A. Degree in 1918. He was also created D.C.L. in 1832.

From early age Vigors had been forming extensive collections of birds and insects and these he presented to the Zoological Society which he helped in founding in 1826. He was the first secretary of the Society and held the office till 1833. His famous paper *On the natural affinities that connect the orders and families of birds* was published in 1819 in the *Transactions* of the Linnean Society. Between 1825 and 1836 he wrote some forty papers on ornithology. He assisted Sir William Jardine and Prideaux John Selby in their *Illustrations of ornithology* (1825–39) and wrote the section *Ornithology* for the *Zoology of Captain Beechy's voyage* (1839). He was also for some time joint editor of the *Zoological journal* (1828–35).

After sitting in Parliament for about eight years, as an advanced liberal, Vigors died at his house in Chester Terrace, Regent's Park, London, October 26, 1840.

Kohlrausch, Friedrich Wilhelm (1840-1910)

FRIEDRICH WILHELM KOHLRAUSCH, a German physicist, was born at Rinstein, October 14, 1840. Having studied at Gottingen and Erlangen, he became a professor of his University in 1866. After seeing some other appointments he became professor of physics in the University of Wurburg in 1875 and of Strassburg in 1888.

Physics was in the family so to speak. Kohlrausch's father was himself a physicist of great distinction. In conjunction with Weber he carried out for the first time a determination of the ratio of the electromagnetic to the electrostatic unit of electrical quantity and thus laid the foundation for the absolute system of electrical measurements. The son also specialised in the same subject. He also did much original work on the conductivity of solutions.

Kohlrausch wrote many papers and he is best known among students for his justly famous *Leitfaden der praktischen Physik* (1870) which was the first and also pronounced to be the best of its kind. It reached the eighth German edition in 1896 and went through two editions in English.

Kohlrausch died at Merburg, February 1910.

S. R. RANGANATHAN.

University Library,
Madras.

SCIENCE NOTES AND NEWS

Rare Fossils of Extinct Animals.—The discovery in the Badlands of South Dakota, of fossil bones of seventy-three specimens of extinct animals of the American West was announced recently by the *National Geographic Society*. The finds, many rare, and some probably new to science, were made by a paleontological expedition under the joint auspices of the Society and the South Dakota State School of Mines, under the leadership of Dr. Joseph P. Connolly, President of the School.

One of the outstanding specimens is the largest rhinoceros skull and jaws yet found in the Badlands, the skull approximately 28 inches long. Another is a pig skull and jaws, 30 inches long, probably a new genus; and still another the joined skull and jaws of a protoceros, a queer six-horned creature remotely related to deer and antelope. Leg bones of a bird which had a body larger than that of the domestic turkey of to-day are believed to have belonged to a wading bird comparable to a crane, of a previously unknown species. Bird bones are extremely rare in the Badlands formations.

Other important and interesting specimens found include a fossil egg not yet identified; and bones of three-toed horses about the size of sheep; peccaries; tapirs; oreodonts, small, long-tailed, cud-chewing animals; ancodonts, somewhat similar creatures; ancodus, a sort of pig-hippopotamus; a wild dog; a small insect-eating creature, apternodus, the fossil remains of which are extremely rare; and other insect-eaters, as well as rodents. An unusual discovery turned up several skulls of baby rhinos, their youth shown by their "milk teeth".

The Total Solar Eclipse of October 1.—The expedition organised by the *National Geographic Society* and the *National Bureau of Standards* to observe the total solar eclipse of October 1, will go down to history as one of the most carefully planned and best equipped expeditions. The observation post lay in the neighbourhood of the village of Patos, in the heart of one of Brazil's most important cotton growing regions, some 200 miles from Recife (Pernambuco), Brazil. The programme followed by the expedition included "a complete motion picture record, in colour, of the eclipse from the appearance of the first nick in the sun's disk until the moon completely passed across its face; photographs of the 'flash spectrum' of the sun at the two instants when this phenomenon is visible (just before the beginning and just after the end of totality); repeated photographs of the spectra of the corona during the five minutes of totality; special large photographs of the corona, both in black-and-white and in colour, with varying exposures; records of the polarization of the coronal light; radiation, sky spectra, and temperature and density changes in the atmosphere during totality".

The two spectrographs used by the expeditionists are of unusual design; they are slitless, using concave gratings and no lenses. One instrument was employed for photographing the spectrum between 3,000 and 5,500 Å and the other between 5,000 and 10,000 Å. One of the gratings with 15,000 lines to the inch was prepared by Robert W. Wood of John Hopkins, and the other by Henry G. Gale of the University of Chicago, had 30,000 lines to the inch. Almost all the instruments used for observation were "tied together" by a combined electric and vacuum control system, making the operation of the numerous units almost completely automatic.

The results of the expedition are awaited with much interest.

Adult Education in India.—Appendix III to the *Proceedings* of the fifth meeting of the **Central Advisory Board of Education in India** is really, for the most part, a Report on Adult Education in India, as indicated in its sub-title. The Committee which makes the Report was set up by the Central Advisory Board on Educaticn in 1939.

Adult education is a problem in which not only officers of government but all persons interested in education must be well informed. Therefore a valuable Report such as this should be published in a form likely to attract the attention of the general public.

The first twenty pages of the booklet, which contains the main body of the Report, presents a most careful consideration of the problem of adult education in this country in all its aspects. To begin with, the problem is defined and distinguished from what goes on in Europe under the same name. Thereafter, various practical suggestions are offered in regard to the organization, technique, aids and appliances, preparation of teachers, and finally, administration and finance. No less than twenty-six separate recommendations are made, and with most of these the Advisory Board is in substantial agreement. The rest of the booklet is occupied with an account of the measures taken in recent years by the various provincial governments as well as by the governments of the larger Indian States in order to promote adult education.

It is sometimes complained that valuable official publications remain in obscurity because they are not well got up and given arresting titles. There is no doubt that this is the case here. The booklet is got up in a format which affords no clue as to the value of the material inside its covers. On the contrary, everything about the booklet is suggestive of matters of passing interest. The light is thus hidden under a bushel.

Appendix IV to *Proceedings* of the Fifth Meeting of the Central Advisory Board of Education in India, 1940, is a sister publication to the preceding one; and although it suffers from the same disadvantages as to title and format, they do not seem to matter very much here since the contents of the Report are of far less permanent value and far more controversial in character. It is, in fact, not a single Report, but two Reports under one cover, both dealing with the Wardha Education Scheme. There are also a few Appendices containing the opinions of certain bodies who have had to consider the scheme. A great deal is already known about the scheme and about the differences of opinion which prevail in regard to it. In these circumstances experience, not arguments, seems to offer the best guidance. Nevertheless, the Report is useful as part of the literature on what is known as Basic Education. D. S. GORDON.

Nutrition Research in India.—"Apart from specific contributions to science, the Coonoor research unit has since its inception laboured to put nutrition on the map in India and to-day the importance of nutrition to public health in India is generally realised," says a recent note on the work of the Nutrition Research Laboratories, Coonoor.

During the last five years, great attention has been paid to diet surveys and upto the present time over 60 diet surveys have been carried out in various parts of India. The main object of diet surveys is to discover the defects of Indian diets and indicate the changes and improvements which are desirable from the standpoint of nutrition. A considerable number of points of importance in connection with agricultural and public health policy have emerged as the result of the surveys and these have been summarised in a note which has been circulated to agricultural departments.

The Nutrition Advisory Committee is concerned with the development of nutrition work in India and includes as members the Public Health Commissioner, the Agricultural Commissioner and the Animal Husbandry Commissioner with the Government of India, the Director of the Nutrition Research Laboratories, some university professors of physiology and others with special interest in and knowledge of the subject.

The *Annual Report* for the year 1938–39 of the **Poona Irrigation and Hydrodynamic Research Station** (*Research Publication* No. 2, Manager of Publications, Delhi, 1940; pp. 323; Price Rs. 7–8–0 or 11*sh.* 6*d.*) gives an account of experiments undertaken during the year.

A curved approach channel and a raised sill have been indicated by experiments on models of the River Indus and Lloyd Barrage as a possible solution to reduce silting in the right bank canals, particularly in the north-western perennial canal. As a result of model experiments it was found that a spur 180 feet long sloping down at 1 in 5, pointing 35 degrees upstream would deflect the course of the River Watrak away from the north-west corner of the Kaira Town and thus afford the town ample protection.

Experiments are being conducted on a model of the Ganges above the Hardinge Bridge (E.B. Railway) with a view to reproduce the changes in the course of the river, the greatest difficulty being experienced in the correct reproduction of silt deposition which largely affects the river movements. To determine the best means of protecting bridge piers against scour, experiments are being carried out with special reference to the Hardinge Bridge. Training of the River Sarda above the barrage at Bannabassa and the River Jumna at New Delhi has continued to be the subject of model investigations.

The employment of the hot wire anemometer, generally used to record the speed variations in turbulent flow of air stream, will, it is believed, greatly aid the study of turbulent motion in water.

Part III of the *Report* dealing with several enquiries made of the Station from various parts of India and the recommendations suggested on a variety of problems is an evidence of the increasing appreciation of the usefulness of the Research Station. C. GOPALAKRISHNAN.

The Second Annual Meeting of the **Indian Chemical Manufacturers' Association** was held at Calcutta, on the 3rd October 1940, under the chairmanship of Sir P. C. Ray, the outgoing President. The President's address dealt with a number of subjects of importance to the Indian Chemical Industry. Sir P. C. Ray referred to the stimulus given by the war to the Heavy Chemical Industry. Many of the acids required are now being produced in India and the manufacture of other chemicals such as bleaching powder, caustic soda, etc., has been started on a small scale. If proper encouragement is given, these industries are bound to develop. Sir P. C. Ray pleaded for greater co-operation between manufacturing firms and research institutions. He suggested the formation of a *Chemical and Pharmaceutical Research Advisory Board*, consisting of representatives from Research Institutes and the Indian Chemical Manufacturers' Association.

Another subject referred to by the President was the difficulties the Pharmaceutical Industry had to contend with, such as unfavourable excise regulations, high railway freights and the activities of the Medical Stores Depots, which instead of being curtailed were being expanded. The attitude of the Government seems to be one of indifference. Sir P. C. Ray expressed his satisfaction at the passing of the Drugs Act of 1940, by the Government of India; he wondered, however, why representatives of the manufacturers were not included on the *Drugs Technical Advisory Board*.

It is pleasing to note that the membership of the Indian Chemical Manufacturers' Association has now increased to 32 and includes practically all the important firms in India engaged in Chemical Industry. The Association has done excellent work hitherto and it is to be hoped that it will continue to do so under the able guidance of its new President, Raj Mitra B. D. Amin. C. V.

Tuberculosis Association of India.—Consequent on the transfer of the work connected with the manufacture and issue of antirabic treatment, the Association of the Pasteur Institute have offered to place a major portion of their extensive estate at Kasauli, measuring about 30 acres in area, at the disposal of the Tuberculosis Association of India, free of cost, for the establishment of a Tuberculosis Sanatorium on such terms and conditions as may be mutually agreed upon.

The whole scheme for the establishment of the proposed sanatorium at Kasauli has been examined by an Advisory Committee appointed by Her Excellency the President of the Association.

The Sanatorium, when ready, will serve as a central institution for: (*a*) the modern treatment of pulmonary tuberculosis especially difficult cases requiring advanced surgical treatment; (*b*) the training of doctors, nurses and health visitors in the modern methods of diagnosis and treatment of the disease; and (*c*) research work in tuberculosis including bacteriological research.

The Standing Finance Committee of the Indian Legislature at its meeting held at Simla on September 9 and 10, has agreed to the grant of Rs. 3,25,000 (non-recurrent) and Rs. 20,000 (recurrent) to the Association, to cover the cost of establishment and maintenance of the Sanatorium.

A New Substitute for Jute.—According to the *J. Indian Chemical Society* (Industrial and News Edition), 1940, 3, No. 2, technical results obtained from *Macambira* fibre grown in Brazil show that it can be used successfully in manufacturing bags, canvas and a variety of products when mixed with the 'caroa' fibre. For both the fibres there is abundant raw material in Brazil. Industrial utilisation of these fibres was initiated by the Fabrica Yolanda, S.A.

The following students of the **Imperial Agricultural Research Institute**, New Delhi, have been awarded the Diploma of the Institute (*Assoc. I.A.R.I.*) after the completion in Septemper 1940, of their two-year post-graduate courses and the acceptance by the Institute Council of theses submitted by them as mentioned against each:—

Botany.—Mr. H. C. Mirchandani (A study in the variability of Afghanistan wheats). Mr. Y. R. Mehta (Studies in vernalization of mustard, gram and wheat). Mr. M. J. Deshmukh (Studies concerning the seed setting and agricultural value in berseem and allied species). Mr. Mohd. Jafar (An interspecific cross between *Triticum vulgare* Host and *Triticum vavilovi* Jakub: its segregation and importance). Mr. M. P. Narasimha Rao (Studies in Indian Oleiferous Brassicæ). Mr. Harbhajan Singh (I. Studies in the egg-plant *Solanum melongena* L.; II. Freezing experiments with some cultivated and wild potatoes).

Agricultural Chemistry.—Mr. K. C. Batra (Part I—Relationship between mechanical analysis and some single value constants; Part II—A comparative study of some more important ordinary and rapid methods of estimating exchangeable bases in soils). Mr. N. G. C. Iyengar (Biochemical studies on some Imperial Pusa wheats. Part I—The effect of fertilizer and cattle manure on the protein fractions; Part II—Differences in the chemical composition of some Pusa wheats grown on different soils). Mr. K. M. Mehta (Part I—The relationships between mechanical analysis, moisture equivalent and sticky point in Indian soils; Part II—Comparative study of some rapid chemical methods of estimating nitrogen and phosphorus in soils with the usual official methods. Mr. V. N. Prasad (Relationship between moisture equivalent, sticky point and clay content of soils).

The following students have successfully completed one year post-graduate course in Agriculture: Messrs. Jagdish Narain Misra, Ranbir Singh and N. Y. Karkare.

The New Hydraulic Laboratory of the National Research Council, Ottawa (Canada).—The National Research Council has recently provided in Ottawa, facilities for hydraulic structures research. Hon. J. A. MacKinnon, Chairman of the Committee of the Privy Council on Scientific and Industrial Research, which deals with matters of policy relating to the National Research Council, states that the laboratory has been set up on the recommendation and under the guidance of a Committee composed of technical representatives from four Dominion Government departments.

The new laboratory, which is a part of the Division of Mechanical Engineering, has been planned to supplement the limited facilities which are at present available in Canada for work of this kind. Space and equipment have been provided for model research on many classes of hydraulic structure to a scale, which will ensure correct flow conditions and freedom from uncertainty regarding "scale effect". The design of structures such as canal locks, dams, spillways, gates and power plant details can be investigated and work may be undertaken on river hydraulic problems of limited extent. Many pipe-flow problems are also within the scope of the laboratory. A feature of the laboratory is the large flow of water available which will be adequate for the largest models that can be accommodated. The present location of the hydraulic equipment is temporary, and the equipment has been designed for more commodious quarters for which plans have been made.

This hydraulic laboratory provides the engineering profession with a useful tool not hitherto available in Canada for the solution of many problems in hydraulic design. The new laboratory is provided to serve the needs of the country, and its facilities are available not only for investigations of national interest but also for the solution of those specific problems which arise in private industrial development.

A complete description with drawings, of the new hydraulic laboratory was published recently in *The Engineering Journal*. Reprints (N.R.C. No. 937) are available from the National Research Council at Ottawa.

ASTRONOMICAL NOTES

Transit of Mercury.—On November 11–12, will occur a transit of the planet Mercury across the Sun's disc. The egress only will be visible in India, the ingress happening before sunrise. At Madras the times of the interior and exterior contacts at egress are November 12, $7^h\ 23^m$ and $7^h\ 25^m$ a.m. respectively, Indian Standard Time. With some optical aid, the planet may be seen at sunrise, as a dark round spot near the north-western edge of the Sun's disc.

Planets during November 1940: Mercury after crossing the Sun's disc on November 12, passes into the morning sky and reaches greatest elongation west of the Sun (20° 11′) on November 29, when it will appear as a reddish star of magnitude −0·2. Venus will continue to be a bright object visible over the eastern horizon for about two hours and a half before sunrise. In the same part of the sky is Mars which although not so conspicuous, can be seen as a red star of the second magnitude.

Jupiter will be in opposition to the Sun on November 3, and will be at its brightest, the stellar magnitude during the month being −2·4. Saturn which continues to be apparently close to it, reaches opposition on November 4 and thus both the planets will be rising at about sunset this time and can be seen throughout the night. A close conjunction of Saturn with the moon will occur on the morning of November 14. In Taurus, about five degrees south of the cluster Pleiades, is Uranus which is in opposition to the Sun on November 16, and will be just visible to the naked eye as a faint star of the sixth magnitude.

Meteoric Showers: Two of the chief annual meteoric showers will occur during the month; the Leonids, about November 13–15 and the Andromedes, November 17–27. The radiant point of the Leonids is in R.A. $10^h\ 0^m$ Dec 22° N while that of the Andromedes is in R.A. $1^h\ 40^m$ Dec 43° N. It may be noted that the latter move in the path of Biela's Comet, which disintegrated and was last seen in 1852.

T. P. B.

SEISMOLOGICAL NOTES

During the month of September 1940, four moderate and six slight earthquake shocks were recorded by the Colaba seismographs as against one moderate and four slight ones recorded during the same month in 1939. Details for September 1940 are given in the following table:—

Date	Intensity of the shock	Time of origin I. S. T.		Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Depth of focus	REMARKS
1940		H.	M.	(Miles)		(Miles)	
Sept. 3	Moderate	20	10	1550	Near 32°·0 N., 92°·5 E., to the north of Lhasa in Tibet		
4	Slight	01	27	1510			
5	Slight	00	41	1630			
12	Slight	05	51	3550			
12	Moderate	18	47	5550			
21	Moderate	19	19	1210	36° N., 71° E. in the Hindukush mountains	150 (approx.)	Felt severely in Peshawar and moderately in Lahore.
22	Slight	09	08	1650			
23	Moderate	04	22	3450	Near 9° N., 124° E., in the southern Philippine Islands	400 (approx.)	
25	Slight	01	02	1760			
26	Slight	09	26	5750			

MAGNETIC NOTES

The month of September 1940 was magnetically less disturbed than the previous month. There were 9 *quiet* days, 19 days of *slight* disturbance and 2 of *moderate* disturbance as compared with 11 quiet days, 17 days of slight disturbance and 2 of moderate disturbance during the same period of 1939.

The day of largest disturbance during the month of September 1940 was the 26th and that of least disturbance the 23rd. The characters assigned to individual days are shown below.

Quiet days	Disturbed days	
	Slight	Moderate
6, 10–13, 17, 23, 24, 29,	2–5, 7–9, 14–16, 18–22, 25, 27, 28, 30	1, 26

Magnetic Storms.—One moderate magnetic storm of short duration with a "sudden commencement" in all the three elements was recorded on the 26th September 1940. This is the only storm recorded during the month as compared with a moderate storm recorded during the month of September 1939.

The mean character figure for the month of September 1940 is 0·77 as against 0·70 for the same period of last year.

M. R. RANGASWAMI.

ANNOUNCEMENTS

Tuberculosis Association of India.—The Tuberculosis Association of India, with the co-operation of the Bombay Province Anti-Tuberculosis Association, will organise a medical post-graduate course for training in tuberculosis in Bombay, Panchgani and Wanlesswadi from the 13th January to 1st February 1941, both dates inclusive. During the first two weeks lectures and practical demonstrations will be held in Bombay at the Seth G. S. and Grant Medical Colleges and other institutions, and during the third week at the Tuberculosis Sanatoria in Panchgani and Wanlesswadi.

The class will be limited to 25 registered medical practitioners. Fifteen seats will be reserved for practitioners in Western India, including Indian States, and the remaining for candidates from other parts of India.

Applications for the course in prescribed form should reach the Secretary, Tuberculosis Association of India, New Delhi, by the 22nd November 1940.

The Tuberculosis Association also hope to organise a similar course in Calcutta early next year with the co-operation of the Bengal Tuberculosis Association.

International Congress of Pure and Applied Science.—The Second International Congress of Pure and Applied Science scheduled to be held at Columbia University, New York, in September 1940 has been postponed. As soon as possible, arrangements for the Congress will be made and a new date set by the Executive Committee after consultation with members of the National Committee. L. W. Tomarkin, Secretary-General, Columbia University, will continue to receive communications pertaining to the Congress.

The National Cancer Institute of the National Institute of Health of the U.S. Public Health Service, announces the establishment of *The Journal of the National Cancer Institute* as the official organ of the Institute. The new journal, which will be issued bi-monthly, will contain articles by the members of the staff on the various lines of cancer research work carried on by the Institute. The first issue will include papers on the federal cancer control programme, approaches to cancer research, the effect of various hydrocarbons in producing tumors in mice and studies on normal and cancerous tissues. The journal will be sold by the Superintendent of Documents, Government Printing Office, Washington, D.C. It will be distributed free to a limited number of medical schools, to workers in the field of cancer research, to research institutes interested in cancer, to a limited number of surgeons, as well as to certain government depositories and to journals making suitable exchanges.—(*Science*, 1940, 92, 2379.)

Microfilm Sets of Periodicals.—*The Committee on Scientific Aids to Learning*: President James B. Constant, of Harvard University, has made a grant to cover the cost of making microfilm master negative, on the most expensive film, of sets of volumes of scientific and learned journals.

This permits the non-profit Bibliofilm Service to supply microfilm copies at the sole positive copy cost, namely, one cent per page for odd volumes, or a special rate of half a cent per page for any properly copyable ten or more consecutive volumes.

The number of pages will be estimated on request to the American Documentation Institute, 2101, Constitution Avenue, Washington, D.C.—(*Chemical Reviews, June* 1940, p. 472.)

We acknowledge with thanks the receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 88, Nos. 4566–67.

"Agricultural Gazette of New South Wales," Vol. 51, Pt. 9.

"Indian Journal of Agricultural Science," Vol. 10, Pt. 4.

"Biochemical Journal," Vol. 34, No. 7.

"Journal of the Institute of Brewing," Vol. 46, No. 8.

"Biological Reviews," Vol. 15, No. 3.

"Journal of the Indian Chemical Society," Vol. 17, Nos. 6–7.

"Chemical Products," Vol. 3, Nos. 7–8.

"Comptes Rendus (Doklady)," Vol. 27, No. 4.

"Indian Forester," Vol. 66, No. 10.

"Indian Forest Records," Vol. 6, No. 4.

"Transactions of the Faraday Society," Vol. 36, No. 232.

"Indian Farming," Vol. 1, No. 9.

"Transactions of the Geological, Mining and Metallurgical Society of India," Vol. 12, No. 2.

"Bulletin of the Indian Central Jute Committee," Vol. 3, No. 6.

"Review of Applied Mycology," Vol. 19, Pt. 7.

"The Mathematics Student," Vol. 8, No. 2.

"The Bulletin of the American Meteorological Society," Vol. 21, No. 6.

"Indian Medical Gazette," Vol. 75, No. 9.

"Journal of the Indian Mathematical Society," Vol. 4, No. 3.

"Journal of the Mysore University," Vol. 1, Pts. 7–8.

"Journal of the Bombay Natural History Society," Vol. 41, No. 4.

"Journal of Nutrition," Vol. 20, No. 2.

"Nature," Vol. 146, Nos. 3690–93.

"Indian Journal of Physics," Vol. 14, Pt. 3.

"Canadian Journal of Research," Vol. 18, No. 7.

"Sky," Vol. 4, No. 10.

"Science and Culture," Vol. 6, No. 4.

"Indian Trade Journal," Vol. 138, Nos. 1777–89.

"Indian Journal of Veterinary Science and Animal Husbandry," Vol. 10, Pt. 2.

"Arkiv Fur Zoologi," Band 32, Nos. 2–3.

ACADEMIES AND SOCIETIES

Indian Academy of Sciences: (*Proceedings*)

September 1940. SECTION A.—MATA PRASAD AND K. V. MODAK: *Measurement of opacity during the coagulation of the concentrated sols of zirconium and stannic hydroxides and the gelation of stannic phosphate and zirconium hydroxide gel-forming mixtures.*—The results fail to show any distinct differences between the processes of coagulation and gelation. GURDAS RAM AND V. I. VAIDHIANATHAN: *Pressure under a flush floor with inclined sheet piles.* B. K. MALAVIYA AND SIKHIBHUSHAN DUTT: *Chemical examination of the essential oils derived from* Anethum soa *Roxb. oil from the green herb and the seeds.* S. A. SETLUR AND V. V. NADKARNY: *Action of phosphorus halides and thionyl chloride on benzilic acid.* α-Chlorodiphenylacetic acid is formed in good yields. D. C. MIDHA: *A note on the negative pressure and moisture content of a Punjab soil.* K. GANAPATHI: *Chemotherapy of bacterial infections—Part III. Synthesis of* (N^1)*-amino-substituted heterocyclic derivatives of sulphanilamide.*—For pronounced anti-bacterial action the heterocyclic ring should be substituted in the sulphonamide radical leaving a free amino group, which appears to play some significant role in the mechanism of therapeutic action. T. VIJAYARAGHAVAN: *The general rational solution of some diophantine equations of the form*

$$\sum_{r=1}^{k+1} A_r x^n r = 0.$$

S. V. ANANTAKRISHNAN AND R. VENKATARAMAN: *The kinetics of the olefin-bromine reaction—Part I. The dark reaction in acetic acid solution—Part II. The critical increment of the reaction in acetic acid.*—The course of the reaction clearly indicates a chain mechanism. B. D. SAKSENA: *Raman spectra and hydroxyl frequencies of some fatty acids.* Formic, acetic, dichloracetic and trichloracetic acids have been studied. B. D. SAKSENA: *The Raman spectra and the molecular structure of some aliphatic cyclic compounds. (Cyclohexane, cyclohexanol, cyclohexanone, dioxane and paraldehyde).*—The ring frequencies for the *trans*-model (symmetry S_{8h}) of cyclohexane have been worked out, and the polarisation and the Raman effect data of different compounds have been analysed in relation to their molecular structures. S. BHAGAVANTAM AND J. BHIMASENACHAR: *Modified reflection of x-rays by crystals: Calcite.*

September 1940. SECTION B.—KHAN A. RAHMAN: *Important insect predators of India.* B. S. CHAUHAN: *Two new species of avian trematodes.* BRAHMA SWARUP KAUSHIVA: *The arterial system of the pond-turtle,* Lissemys punctata *(Bonnaterre).*

Indian Association for the Cultivation of Science (*Proceedings*):

June 1940.—HARIDAS BAGCHI: *Geometrical note on van der Waal's equation.* R. L. NARASIMHAIYA AND C. S. DORAISWAMI: *A new technique for determining ultra-sonic velocities in liquids.* A. K. DAS AND M. SALARUDDIN: *Measurement of cosmic rays at Agra and Kodaikanal.* A. L. SUNDARA RAO: *Raman spectra of sugar.* S. R. KHASTGIR AND C. CHOWDHURY: *On the dielectric constant of an electronic medium at medium frequency.* K. BANERJEE AND M. GANGULY: *Determination of the structure of m-dinitrobenzene by Patterson Fourier Summation.* G. N. BHATTACHARYA: *A note on the refractive index of shellac.* M. KAMESHWAR RAO: *High-frequency measurements of the amplification factor and internal resistance of a thermionic valve.*

Indian Chemical Society (*Journal*):

June 1940.—S. S. BHATNAGAR, A. N. KAPUR AND M. S. BHATNAGAR: *Adsorptive properties of synthetic resins—Part IV.* MATA PRASAD AND M. A. NAQVI: *Heterogeneous reaction between chromic sulphate and manganese dioxide.* SANTI RANJAN PALIT: *A new method of preparing hydrosols of shellac and other natural resins and their properties.* M. S. TELANG AND V. V. NADKARNY: *Kinetics of the reaction between potassium persulphate and alkyl iodides—Part III.—Catalytic activity of a weak acid.* HIRALAL SHRIVASTAVA: *Kinetics of the saponification of esters in dilute solutions. A study of the effect of substitution on the rate-determining factors.* R. K. BAHL AND MANOHAR LAL: *The interaction between potassium* metaperiodate *and the soluble salts of metals of alkaline earths.* R. K. BAHL AND SURJIT SINGH: *The action of chlorine on the hydroxides of alkaline earths in the presence of iodine—Part II.* K. N. GAIND, JNANENDRA NATH RAY AND JAYANT N. YAGNIK: *Synthesis of local anæsthetics—Part IV.* G. C. ESH AND S. S. GUHA-SIRCAR: *An investigation on the soil and peat humic acids—Part II. Oxidation with hydrogen peroxide, hot alkali and chlorine dioxide solution.* BHUPAL CHANDRA RAI-SIRCAR: *Estimation of carotene in green vegetables by the Hilger-sector photometer.* HAYAWADAN VAMANRAO DHARWARKAR AND RUPCHAND LILARAM ALIMCHANDANI: *Reactivity of $CHCl.CCl_3$-group attached to an aromatic nucleus.*

July 1940.—D. K. BANERJEE: *Synthetic investigations on the degradation products of bile acids, sex hormones, etc.—Part I. A synthesis of 7-methyl-0 : 3 : 3-bicyclooctane-1-one.* P. S. MACMOHAN AND BIJAN BIHARI LAL: *Photochemical after-effect in the oxalate-iodine reaction.* R. K. BAHL AND SURJIT SINGH: *The ternary system, potassium nitrate, ammonium nitrate and water at 25°.* G. V. SHIROLKAR, I. S. UPPAL AND K. VENKATARAMAN: *The Sulphonation of monoethylaniline.* B. K. NANDI: *Chemotherapy of Malaria. 6-Methoxyquinoline-8-hydrazine and synthesis of some heterocyclic compounds from it.* D. K. BANERJEE: *Synthetic investigations on the degradation products of bile acids, sex hormones, etc.—Part II. A synthesis of keto-deoxyoestric acid.* SACHCHIDANANDA BANERJEE: *The stability and state of ascorbic acid in urine.* A. C. MAJUMDAR: *Observations on the anterior pituitary-like gonadotropic hormone from the human urine of pregnancy—Part I.* HANS KRALL AND VIDYA SAGAR: *The phenylthiocarbamides. A contribution to the study of the triad-N-C-S—Part IX. Thiobenzamide.*

Society of Biological Chemists, India

(*Bangalore Branch*)

May 21.—G. NARASIMHAMURTHY: *Variation of butter constants due to ageing.*

June 19.—MAHDI HASSAN: *Pigment-producing bacteria.*

August 24.—K. C. SEN: *The Live-stock industry in India.*

September 28.—S. L. VENKITESWARAN: *Enzymic estimation of tyrosine.* P. L. N. RAO: *Sulphanilamide derivatives.* G. B. RAMASARMA AND B. N. BANERJEE: *Some factors affecting the vitamin content of mango fruit.*

Tin and Its Uses

The sixth issue of this Quarterly Review of the *International Tin Research and Development Council*, contains an illustrated article (page 4), describing a special tinning machine designed to produce more uniform and less porous tin coatings on tinplate. This machine embodies certain new features which are not yet employed in industrial practice, one of which is a device for securing a smooth drive for the rollers.

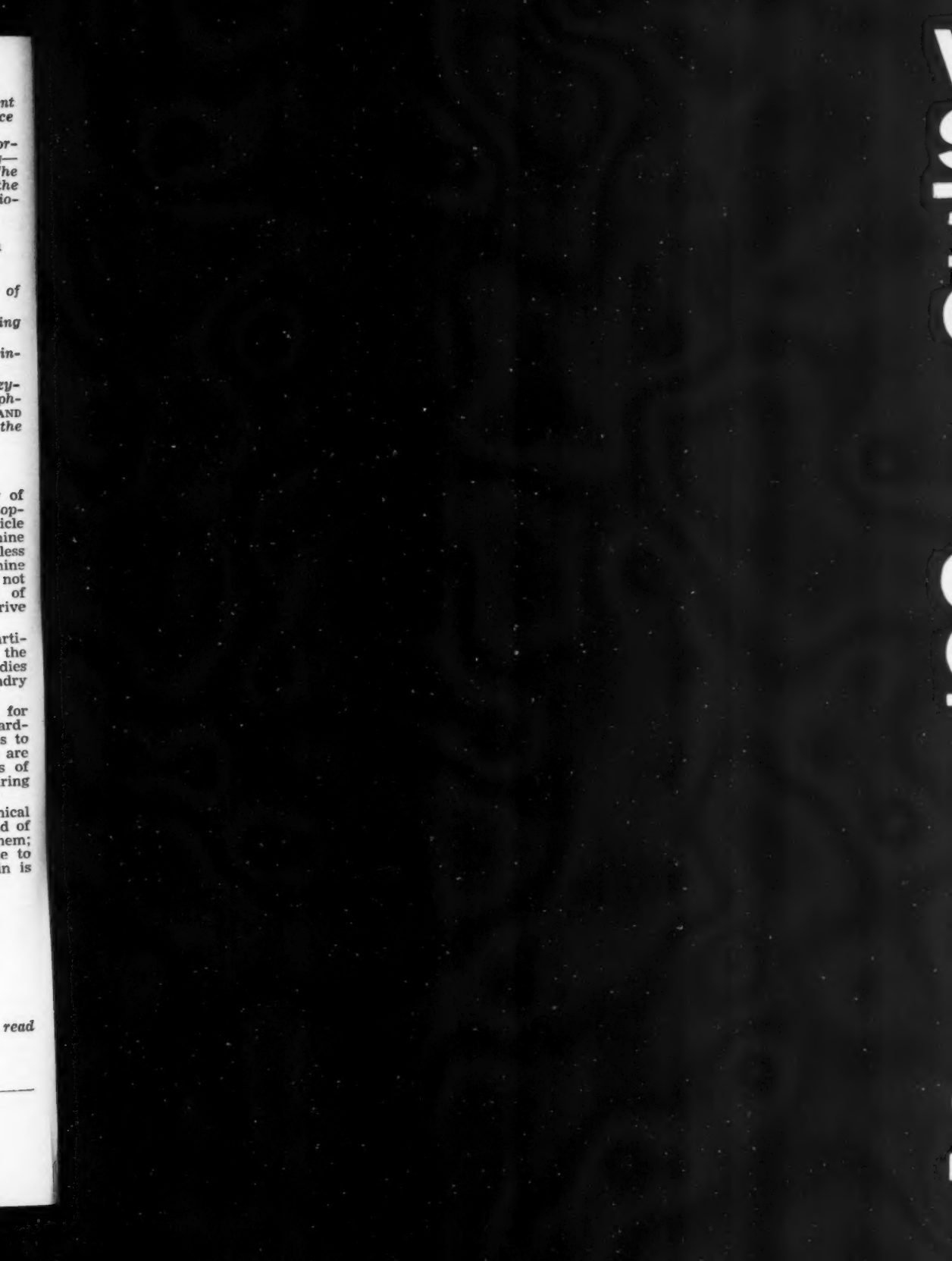
Another article (page 6) which is of particular interest at the present time, explains the uses of fusible alloys for the mounting of dies and punches for press-tool work, for foundry work and for bending tubes and sections.

An article (on page 11) entitled "Fluxes for Soldering" gives important information regarding the types of flux available and the uses to which each type is suited. Further details are given in this issue as to the best methods of ensuring adhesion of bearing metals to bearing shells of cast-iron and alloy steel.

Other articles give examples of technical difficulties encountered by tin consumers and of the Council's suggestions for overcoming them; this service of technical advice is available to any firm engaged on processes in which tin is involved.

ERRATUM

Vol 9, No. 9, September 1940: Supplement:

Article entitled "His Highness Maharaja Sri Jaya Chamaraja Wadiyar Bahadur," p. ii, column 2, third line, *for* "reigns" *read* "reins".

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